APPENDIX B

MULTISTAGE BLOWER INITIAL SUBMITTAL

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Lone Star Blower
8883 West Monroe
Houston, TX 77061

Ph: 832-532-3112
Fax: 832-532-3115

PROJECT SUBMITTAL

ATTN: Thomas Paulmann, PE

DATE: March 9, 2021

PROJECT: Robindale WWTP

OWNER: Brownsville Public Utility Board

ENGINEER: Hazen and Sawyer

EQUIPMENT: (2) LS24-5 Air Blower Packages with Controls

INITIAL MULTISTAGE BLOWER SHOP DRAWING - THE SHOP DRAWING IS CURRENTLY IN ENGINEERING REVIEW AND HAS NOT BEEN APPROVED.

SUPPLIER: LONE STAR BLOWER

SPECIFICATION:
1. Legal Notice and Invitation to Bid B010-21
2. Section 01 33 00 – Submittal Procedures
3. Section 01 78 23 – Operation and Maintenance Data
4. Section 26 05 60 – Low-Voltage Electric Motors
5. Section 26 09 16 – Electric Controls and Relays
6. Section 26 29 13.16 – Low Voltage Enclosed Motor Controllers – Reduced Voltage
7. Section 40 05 57 – Valve Operators and Electric Valve Actuators
8. Section 40 05 64 – Butterfly Valves
9. Section 40 62 63 – Operator Interface Units (OIU)
10. Section 40 63 43 – Programmable Logic Controllers
11. Section 40 66 00 – Network and Communication Equipment
12. Section 40 67 63 – Uninterruptible Power Systems
13. Section 40 73 13 – Pressure and Differential Pressure Gauges
14. Section 40 78 56 – Isolators, Intrinsically-Safe Barriers, and Surge Suppressors
15. Section 43 11 18 – Multistage Centrifugal Blowers
16. Section 46 00 00 – Equipment General Provisions

PROJECT #: S20-12175

REVISION #0: INITIAL SUBMITTAL

(2) LS24-5 AIR BLOWER PACKAGES

SUBMITTAL PACKAGE

PREPARED FOR:
Thomas Paulmann, PE

CUSTOMER PO#: P2100886

LONE STAR PROJECT #: S20-12175

March 9, 2021

TABLE OF CONTENTS

SECTION 4	ACCESSORIES (CONT.)
4.15	INLET DIFFERENTIAL PRESSURE TRANSMITTER
4.16	INLET TEMPERATURE TRANSMITTER
4.17	INLET VACUUM GAUGE
4.18	DISCHARGE PRESSURE GAUGE
4.19	DISCHARGE TEMPERATURE TRANSMITTER

SECTION 5	CONTROLS
5.1	LOCAL CONTROL PANEL (LCP)
5.2	LOCAL CONTROL PANEL J-BOX

SECTION 6	SPARE PARTS
6.1	INLET FILTER ELEMENTS
6.2	PLC MODULES
6.3	PLC
6.4	PLC POWER SUPPLY
6.5	ETHERNET SWITCH
6.6	SURGE PROTECTION DEVICE
6.7	RVSS SMC UNIT
6.8	RVSS CIRCUIT BREAKER
6.9	RVSS CONTROL POWER TRANSFORMER
6.10	RVSS FUSES

SECTION 1

GENERAL DOCUMENTATION

Lone Star Blower
8883 West Monroe
Houston, TX 77061

PH: 832-532-3112
FAX: 832-532-3115

SECTION 1.1

APPROVAL PAGE

Lone Star Blower
8883 West Monroe
Houston, TX 77061

PH: 832-532-3112
FAX: 832-532-3115

SUBMITTAL APPROVAL

City of Brownsville
Robindale WWTP
3208 Robindale Rd.
Brownsville, TX 78521

RE: SUBMITTAL FOR SPECIFICATION APPROVAL – Robindale WWTP, LSB Project Number: S20-12175.

Dear Thomas,

In reference to your recent purchase order for (2) LS24-5 air blower packages, Lone Star Blower is enclosing the following submittal package for your review.

Please indicate your agreement with the attached specifications by signing below and returning a copy to us at awood@lonestarblower.com.

Note that this submittal does not constitute acceptance of any commercial Terms and Conditions, except for what is contained herein. Commercial Terms and Conditions are agreed to via a signed purchase order only.

Sincerely,

Adam Wood
Project Manager

---

*By signing this form, you are approving the release of this order to production, per the specifications herein submitted, as well as verifying the following shipping address and instructions for physical delivery of the equipment.

SHIP TO:

City of Brownsville
Robindale WWTP
3208 Robindale Rd.
Brownsville, TX 78521

Delivery of the proposed equipment: [20-24] Weeks after Lone Star Blower receives project submittal approval

_____ _____
Signature Date

_____ _____
Print Name Title

SECTION 1.2

WARRANTY PAGE

LONE STAR BLOWER
WARRANTY AND LIMITATION OF LIABILITY

The Seller (LONE STAR BLOWER) hereby warrants the LS Series product supplied by the Seller to be free from defects in material and/or workmanship under normal use and service. The warranty will be for a period to begin from start-up of the equipment and will extend for a twenty-four (24) month period. The warranty period will not exceed thirty (30) months after shipment.

This warranty applies to all standard equipment supplied by the Seller. Standard equipment shall be limited to the product make, model, and design as determined by the Seller and shall not cover any customer specified or physical modifications or changes. Standard wear items used in routine maintenance are not covered by the Seller. The Seller will repair or replace any defective part or parts, FOB the Seller's facility, at no charge.

Warranty shall be void if the product is repaired or tampered with in any manner other than by the Seller's authorized service personnel. If inspection does not disclose a defect covered by the warranty, the equipment will be returned to purchaser at its expense or, if purchaser elects, the Seller will repair or replace the equipment and charge for such service at the regular rate.

The Seller makes no warranties, expressed or implied, as to the merchantability or as to the suitability of the equipment for any particular purpose, and the Seller does not warranty the equipment in any manner whatsoever, except as expressly stated in this agreement.

Lone Star Project: S20-12175

Customer: City of Brownsville

Equipment Serial Number: S2012175-2570;
S2012175-2571

SECTION 1.3

ISO CERTIFICATE

PERRY JOHNSON REGISTRARS, INC.

Certificate of Registration

Perry Johnson Registrars, Inc., has audited the Quality Management System of:

Lone Star Blower, Inc

8883 West Monroe Road, Houston, TX 77061 United States

(Hereinafter called the Organization) and hereby declares that Organization is in conformance with:

ISO 9001:2015

This Registration is in respect to the following scope:

Marketing, Sales, Design, and Manufacturing of Liquid and Gas Process Systems

This Registration is granted subject to the system rules governing the Registration referred to above, and the Organization hereby covenants with the Assessment body duty to observe and comply with the said rules.

Terry Boboige

Terry Boboige, President
Perry Johnson Registrars, Inc. (PJR)
755 West Big Beaver Road, Suite 1340
Troy, Michigan 48084
(248) 358-3388

PERRY JOHNSON REGISTRARS, INC.

ANAB ACCREDITED ISO/IEC 17021 MANAGEMENT SYSTEMS CERTIFICATION BODY

PERRY JOHNSON REGISTRARS, INC.

UKAS MANAGEMENT SYSTEMS 0105

The use of the UKAS accreditation symbol is in respect to the activities covered by the Accreditation Certificate Number 0105.

The validity of this certificate is dependent upon ongoing surveillance.

Effective Date:	Revision Date:	Expiration Date:	Certificate No.:
October 3, 2018	October 7, 2019	October 2, 2021	C2018-03974-R1

SECTION 1.4

CLARIFICATIONS

Lone Star Blower
8883 West Monroe
Houston, TX 77061

Ph: 832-532-3112
Fax: 832-532-3115

PROJECT CLARIFICATIONS

- Lone Star is proposing models LS24 for the Robindale WWTP project. The proposed models have a wide range of flow and since we are operating on the lower half of the flow range, Lone Star is proposing to reduce from our 24" inlet to a 16" flow control valve. The reason for this valve reduction is for better and more stable flow control. Having a larger inlet butterfly valve, it would be very difficult if not impossible for the valve to adjust exactly to the desired flow point.

- Lone Star is proposing to omit the inlet expansion joint from this project entirely. With no inlet piping, the inlet expansion joint is not required. Also, due to the height limitations, an expansion joint would cause the complete blower package to exceed the 12'6" height limit in specification section 43 11 18 2.01 C.

SECTION 2

BLOWER DETAILS

SECTION 2.1

FACTORY DATA SHEET

Lone Star Blower
8883 West Monroe
Houston, TX 77061

PH: 832-532-3112
FAX: 832-532-3115

Lone Star Blower
8883 West Monroe • Houston, TX 77061
www.lonestarblower.com

LSB Project #: S20 12175 R# 0

Cust. Project: Robindale WWTP

Customer: Brownsville Public Utility Board
Ship To: Robindale WWTP
3208 Robindale Rd.
Brownsville, TX 78521
Contact: Thomas Paulmann - 682-351-6110
Ship Via: Best Way, Included

Cust. PO#: P2100886
Status: **Unreleased**
Release Date: TBD
Target Date: TBD
Firm Date: TBD
Project Manager: Adam Wood

FACTORY DATA & SPECS

(2) NEW BLOWER -- LS24-5 AIR BLOWER PACKAGES

SERIAL NUMBER (1)	: S2012175	-2570
SERIAL NUMBER (1)	: S2012175	-2571

BLOWER SPECS

DRIVE	: INLET
INLET POSITION	: POSITION 1
DISCHARGE POSITION	: POSITION 1
SHAFT MATERIAL AND SIZE	: 400 SERIES STAINLESS / SHAFT DIAMETER - 3.625"
BEARING HOUSING TYPE	: OPEN
BEARING SIZE	: 6320
SEALS	: LABYRINTH
LUBRICATION	: OIL ; SO-46-LS; 10 QUARTS PER BEARING HOUSING
COATING	: NONE
PAINT	: BLOWER - STANDARD PAINT, GL BLUE COUPLING GUARD - STANDARD PAINT, SAFETY YELLOW
BALANCE DRUM	: STAINLESS STEEL LS24 BALANCE DRUM
COOLING	: EXTERNAL DISCHARGE COOLING FAN

IMPELLER INFORMATION

WHEEL #1 - #5	: IM115

ADDITIONAL COMPONENTS

SKID	: 195" X 51"
MOTOR BASE	: 5013T, SHAFT DIAMETER - 2.875"
MOTOR	: 600 HP, GE, 5013T, TEFC, 460/3/60 BEARING AND WINDING RTD'S, VIBRATION SENSORS, 120V SPACE HEATER
COUPLING	: REXNORD 1088XTSR71XXL
COUPLING GUARD	: OSHA GUARD
CONSTANT LEVEL OILER	: OIL-RITE, 9OZ, PYREX RESERVOIR

ACCESSORIES

LOCAL CONTROL PANEL	: (2) CABLCP-VALVE CUSTOM LOCAL CONTROL PANEL
LOCAL CONTROL STATION	: (2) CUSTOM - NEMA 4X LOCAL BLOWER CONTROL STATION (2) CUSTOM - NEMA 4X LOCAL INLET THROTTLE VALVE CONTROL STATION
SOLID STATE STARTER	: (2) ALLEN BRADLEY, REDUCED VOLTAGE SOLID STATE STARTER
VIBRATION ISOLATORS	: (16) 6" X 6" X 5/8" RUBBER BASE PADS
LUBRICATION	: (2) OIL, 5 GALLON PAIL, SO-46-LS, RED (10 QUARTS PER HOUSING, 40 TOTAL)
INLET FILTER SILENCER	: (2) 16", ENDUSTRA, TRI-VENT P09 SERIES
INLET ISOLATION VALVE	: (2) 16", BRAY, SERIES 30, CI BODY, SS INTERNALS, VITON SEAT, BARE STEM
INLET VALVE ACTUATOR	: (2) ROTORK IQTM 1000 FA12, MODULATING ACTUATOR
INLET SPOOL PIECE	: (2) 24"/16" SPOOL PIECE, 150# ANSI FLANGE
DISCHARGE EXPANSION JOINT	: (2) 18", GENERAL RUBBER, STYLE 1101 MAXI-JOINT, EPDM
DISCHARGE ISOLATION VALVE	: (2) 18", BRAY, SERIES 30, CI BODY, SS INTERNALS, VITON SEAT, CHAIN OP.
DISCHARGE CHECK VALVE	: (2) 18", FLEXI-HINGE, 518 SERIES, WAFER STYLE, VITON SEAT, ALUM INT, SS SPRING, CI BODY

DISCHARGE SPOOL PIECE	: (2) 18" SPOOL PIECE, 150# ANSI FLANGE
BEARING VIBRATION SENSORS	: (4) IMI VIBRATION SENSOR, HT640M80, HIGH TEMP, 4-20ma
BEARING TEMP SENSORS	: (4) CONAX, PT-100 RTD WITH TRANSMITTER, 316SS THERMOWELL
INLET D/P TRANSMITTER	: (2) DWYER, SERIES MS2, DIFFERENTIAL PRESSURE TRANSMITTER
INLET TEMP TRANSMITTER	: (2) CONAX, PT-100 RTD WITH TRANSMITTER, 316SS THERMOWELL
INLET VACUUM GAUGE	: (2) ASHCROFT 1188 LOW PRESSURE BELLOWS GAUGE; 0-10 inWC
DISCHARGE PRESSURE GAUGE	: (2) ASHCROFT 1279 DURAGAUGE PRESSURE GAUGE; 0-20#
DISCHARGE TEMP TRANSMITTER	: (2) CONAX, PT-100 RTD WITH TRANSMITTER, 316SS THERMOWELL
GAUGE ISOLATION VALVES	: (4) STAINLESS STEEL 1/2" ISOLATION BALL VALVE

SPARE PARTS

INLET FILTER ELEMENTS	: (2) SETS INLET FILTER ELEMENTS; ENDUSTRA, LSB1527
PLC MODULES	: (1) OF EACH TYPE AND SIZE OF PLC MODULE
PLC & POWER SUPPLY	: (1) OF EACH TYPE AND SIZE OF PLC & EQUIPMENT POWER SUPPLY
ETHERNET SWITCH	: (1) SPARE ETHERNET SWITCH
SURGE PROTECTION DEVICE	: (2) OF EACH TYPE OF SURGE PROTECTION DEVICE USED
SMC UNIT	: (1) COMPLETE SMC-UNIT FOR RVSS
RVSS CIRCUIT BREAKER	: (1) RVSS MOTOR CIRCUIT PROTECTOR & MOTOR CONTACTOR
CONTROL POWER TRANSFORMER	: (1) RVSS CONTROL POWER TRANSFORMER
FUSES	: (2) SPARE FUSES FOR EACH SIZE/TYPE USED AS PART OF RVSS

COMMENTS

1)	STANDARD MECHANICAL TESTING
2)	PERFORMANCE TESTING: WITNESSED PTC-10 TEST
3)	IMPELLER OVERSPEED TESTING TO 115% OF RATED SPEED
4)	LCP FULL TEST PRIOR TO SHIPMENT
5)	TORSIONAL CRITICAL SPEED ANALYSIS REQUIRED
6)	DRILL AND TAP BEARING HOUSINGS (1/2" NPS) FOR INSTRUMENTATION PROVISIONS
7)	SHIPPING PACKING: HEAT SHRINK / 4X4 BASE
8)	FREIGHT: INCLUDED; BEST WAY
9)	BLOWER, LCP, AND RVSS STARTUP INCLUDED WITH TRAINING
10)	MUST USE GRADE 8 OR STAINLESS HARDWARE

Parts Pulled By: _____ Final Approval Date: _____

Assembled By: _____ Quaility: _____

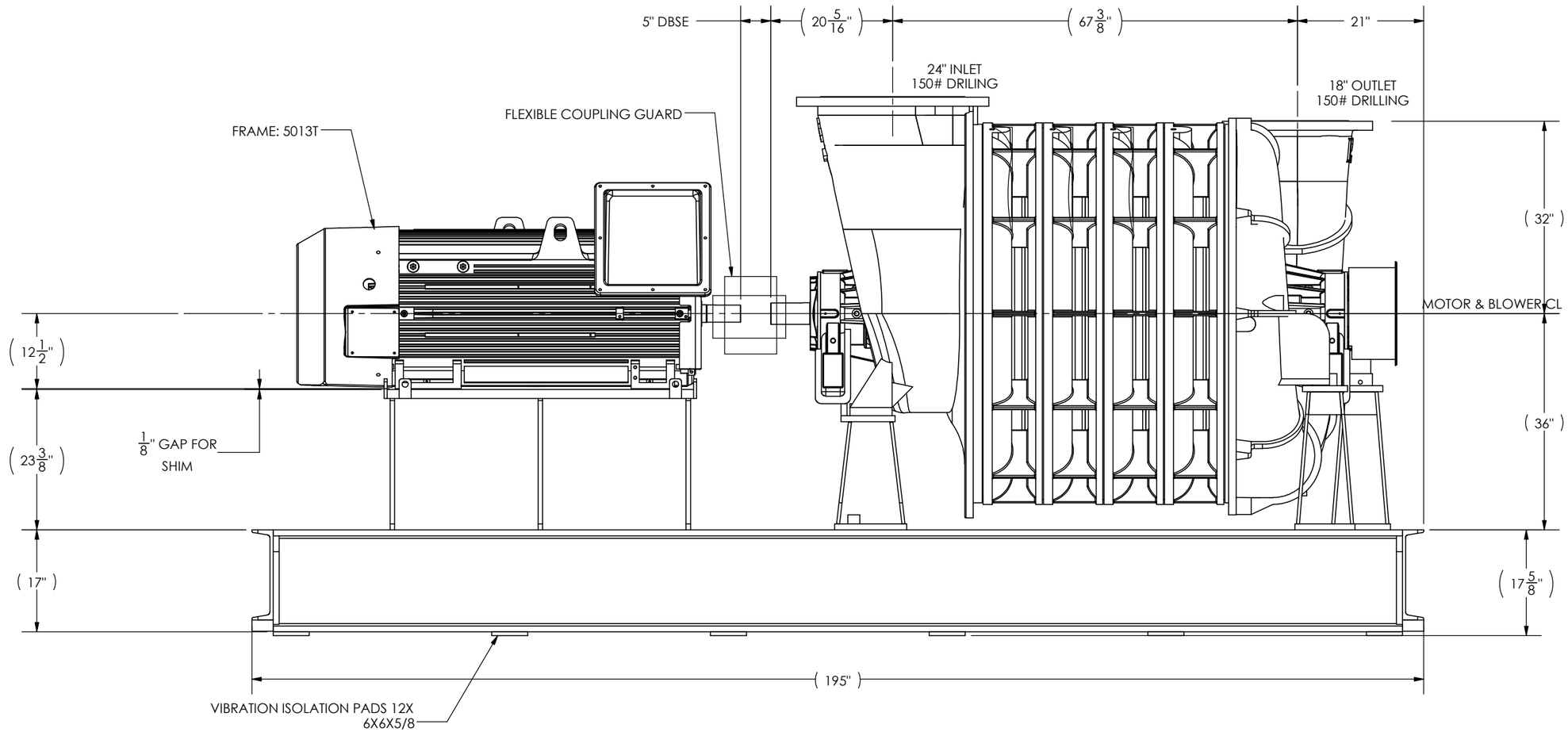
Tested By: _____ Project Mgr: _____

Make Ready By: _____

SECTION 2.2

GENERAL ASSEMBLY DRAWINGS

REVISION HISTORY			
REV	DESRIPTION	DATE	APPROVED



LS24-05 GENERAL ASSEMBLY SIDE VIEW

NOTES:
1. MOTOR IS REFERENCE ONLY
2. DIMENSIONAL ACCURACY +/- 1/16"
3. BLOWERS LOCATED FROM TOP OF SKID I-BEAM TO INLET/OUTLET FLANGE CENTERLINE

PART #	WEIGHT (lb)
1000970390	20561.88 (APPROX)

INTERPET ALL GEOMETRIC DIMENSIONING AND TOLERANCING TO ASME Y14.5

ALL DIMENSIONS ARE IN INCHES UNLESS OTHERWISE SPECIFIED

STANDARD TOLERANCES

.X	±.015
.XX	±.010
.XXX	±.005
X/X	±1/16
ANGLES	± 1°

REMOVE BURRS AND BREAK ALL SHARP EDGES
MACHINED SURFACES 125

DRAWING IS FOR REFERENCE ONLY UNLESS SPECIFIED AS APPROVED

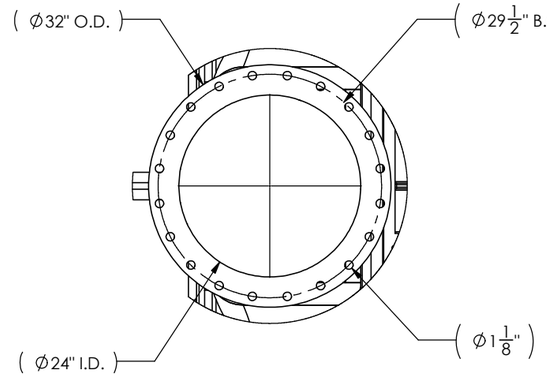
DRAWN BY: TWW	DATE: 3/10/2021
CHECKED BY: ##	DATE: ####
APPROVED BY: CC	DATE: 3/10/2021

THIRD ANGLE PROJECTION

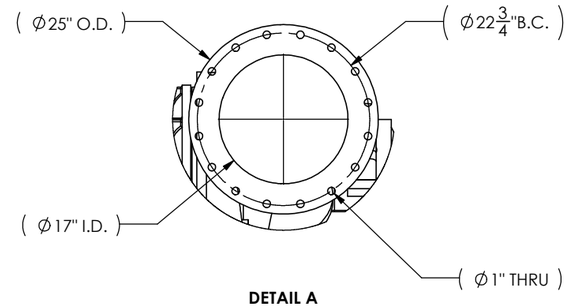
LONE STAR BLOWER
HOUSTON, TX

LS24, 5 STAGE, 5013, DISC COUPLING, INLET 1 OUTLET 1, CUSTOM, 12175

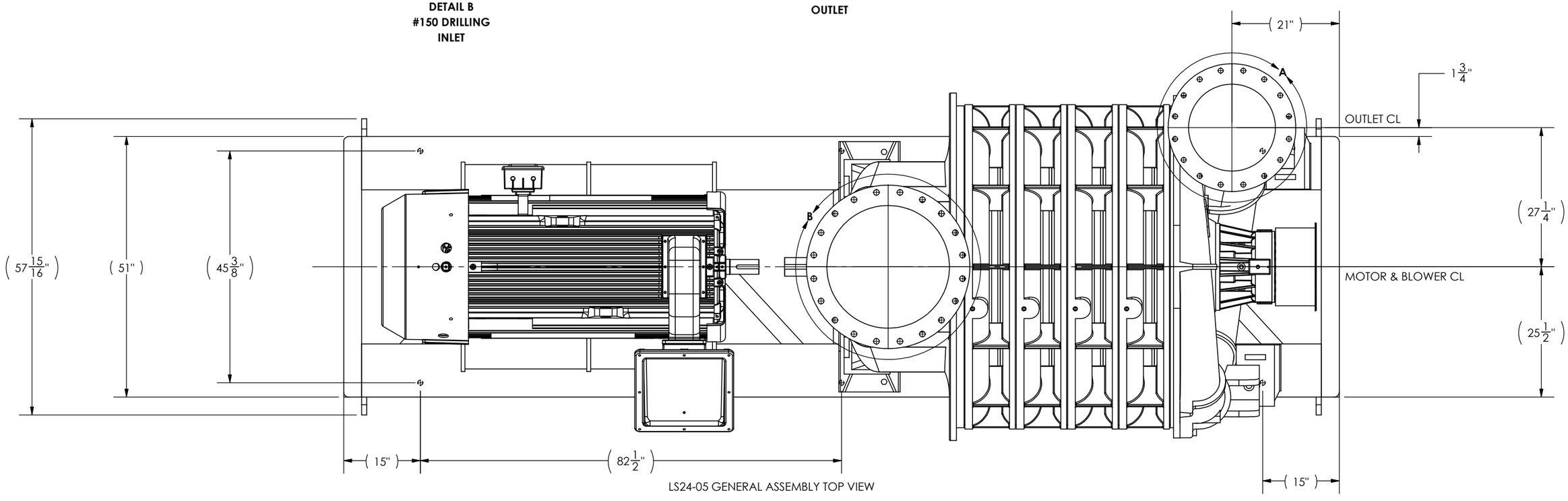
SIZE	DWG. NO.	REV
B	1008001936	0
SCALE: 1:20	DO NOT SCALE	SHEET 1 OF 3



DETAIL B
#150 DRILLING
INLET

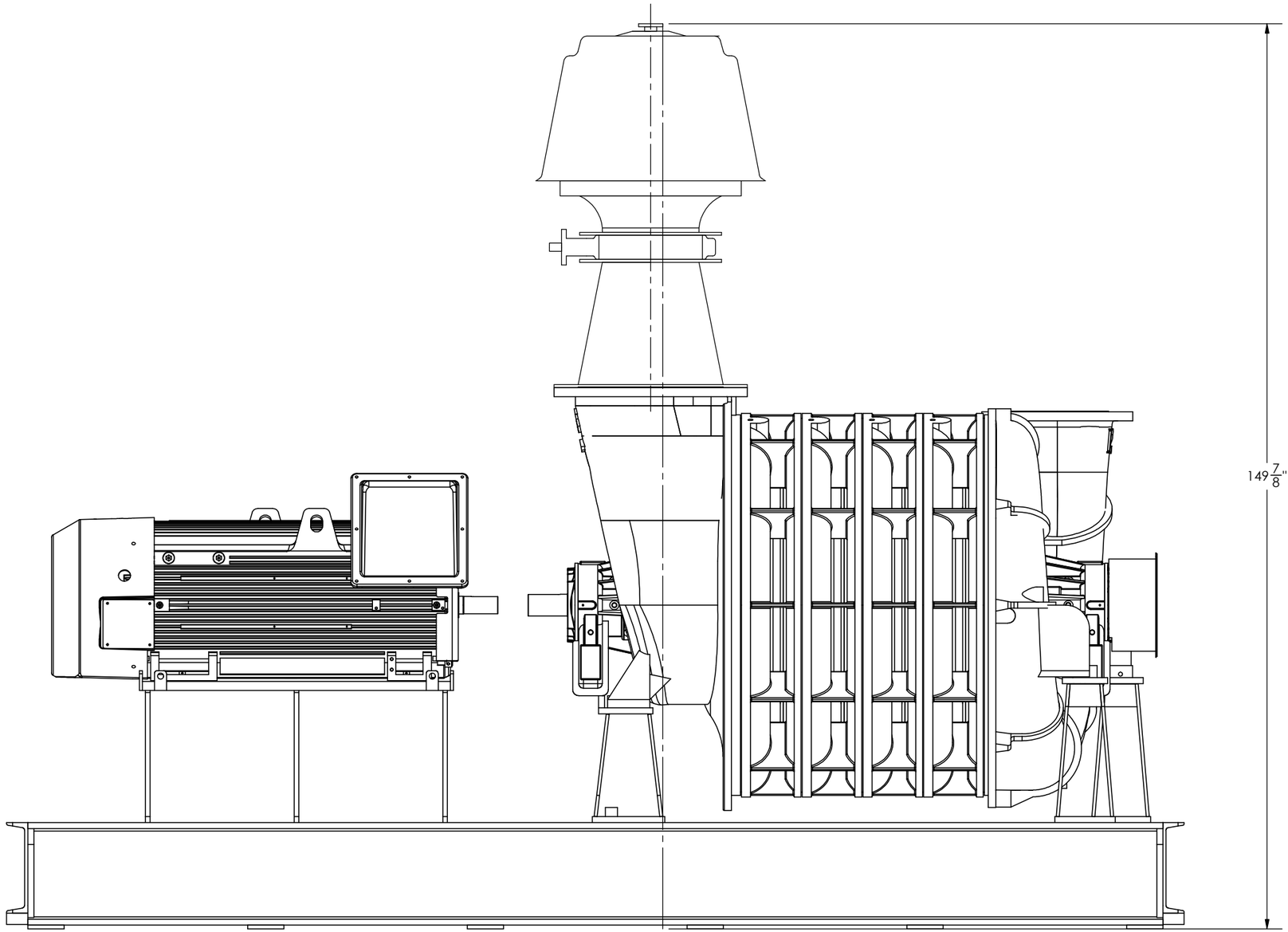


DETAIL A
#150 DRILLING
OUTLET



LS24-05 GENERAL ASSEMBLY TOP VIEW

INTERPET ALL GEOMETRIC DIMENSIONING AND TOLERANCING TO ASME Y14.5	DRAWING IS FOR REFERENCE ONLY UNLESS SPECIFIED AS APPROVED	**LONE STAR BLOWER** HOUSTON, TX
ALL DIMENSIONS ARE IN INCHES UNLESS OTHERWISE SPECIFIED	THE INFORMATION CONTAINED IN THIS DRAWING IS THE SOLE PROPERTY OF LONE STAR BLOWER. ANY REPRODUCTION IN PART OR AS A WHOLE WITHOUT THE WRITTEN PERMISSION OF LONE STAR BLOWER IS PROHIBITED.	LS24, 5 STAGE, 5013, DISC COUPLING, INLET 1 OUTLET 1, CUSTOM, 12175
STANDARD TOLERANCES .X ±.015 .XX ±.010 .XXX ±.005 X/X ±1/16 ANGLES ± 1°	DRAWN BY TWW — DATE 3/10/2021 CHECKED BY ## — DATE #### APPROVED BY CC — DATE 3/10/2021	SIZE B — DWG. NO. 1008001936 — REV 0
REMOVE BURRS AND BREAK ALL SHARP EDGES MACHINED SURFACES 125	THIRD ANGLE PROJECTION	SCALE: 1:20 — DO NOT SCALE — SHEET 2 OF 3



INTERPET ALL GEOMETRIC DIMENSIONING AND TOLERANCING TO ASME Y14.5	DRAWING IS FOR REFERENCE ONLY UNLESS SPECIFIED AS APPROVED	LONE STAR BLOWER HOUSTON, TX
ALL DIMENSIONS ARE IN INCHES UNLESS OTHERWISE SPECIFIED	THE INFORMATION CONTAINED IN THIS DRAWING IS THE SOLE PROPERTY OF LONE STAR BLOWER. ANY REPRODUCTION IN PART OR AS A WHOLE WITHOUT THE WRITTEN PERMISSION OF LONE STAR BLOWER IS PROHIBITED.	LS24, 5 STAGE, 5013, DISC COUPLING, INLET 1 OUTLET 1, CUSTOM, 12175
STANDARD TOLERANCES .X ±.015 .XX ±.010 .XXX ±.005 X/X ±1/16 ANGLES ± 1°	DRAWN BY TWW — DATE 3/10/2021 CHECKED BY ## — DATE #### APPROVED BY CC — DATE 3/10/2021	SIZE B — DWG. NO. 1008001936 — REV 0
REMOVE BURRS AND BREAK ALL SHARP EDGES MACHINED SURFACES 125	THIRD ANGLE PROJECTION	SCALE: 1:20 — DO NOT SCALE — SHEET 3 OF 3

SECTION 2.3

CUT SHEET

Lone Star Blower
8883 West Monroe
Houston, TX 77061

PH: 832-532-3112
FAX: 832-532-3115

Lone Star Blower

LS24 **Multistage Turbo**

Standard Specifications

Number of Stages 5
Inlet Connection ..... 24" Flange, ASA 125# /150# Drilling

Outlet Connection..... 18" Flange, ASA 125# /150# Drilling

Operating Speed..... Design 3,600 RPM - 60 Hz

Case Pressure ..... 30 PSIG / 2 Bar
Seals (Air) ..... Labyrinth Type

Bearings ..... Anti-friction type, AFBMA L10
100,000 hour rating
Lubrication ..... Splash Lubricated Oil

Impeller Diameter..... 37in (939.8 mm) 50 Hz
Impeller Tip Speed ..... 527 ft/s (161 m/s) @ 3550 RPM
First Critical ..... 4531 RPM (5 Stage 60 Hz)
Drive Type..... Direct Coupled
Shaft End..... 3.625 in (92.08 mm) Diameter at Coupling
Vibration Tollerance ..... .18 in/s (4.57 m/s) Maximum

Materials of Construction

Casing..... ASTM A48 Class 30 Cast Iron
Bearing Housings..... ASTM A48 Class 30 Cast Iron
Oil Reservior..... ASTM A48 Class 30 Cast Iron
Shaft ..... ASTM A109 1045 Carbon Steel
Impellers .....
ASTM AA-6061 Fabricated
Seals (Air) ..... ASTM B86 Z35631 Zinc Alloy Aluminum

Interstage Vanes..... ASTM A240 304 Stainless Steel
Joint Sealing..... RTV Silicone Compound
Tie Rods ..... ASTM A108 1045 Carbon Steel
Blower Base..... ASTM A36 Structural Steel
Motor Pedestal ..... ASTM A36 Structural Steel
Isolation Pads..... Neoprene Rubber
Finish ..... 2 Part Epoxy

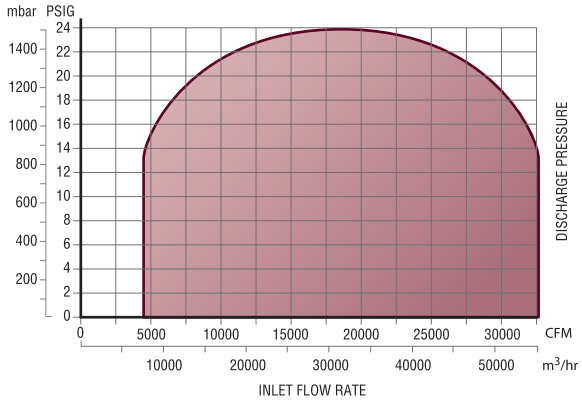
Testing

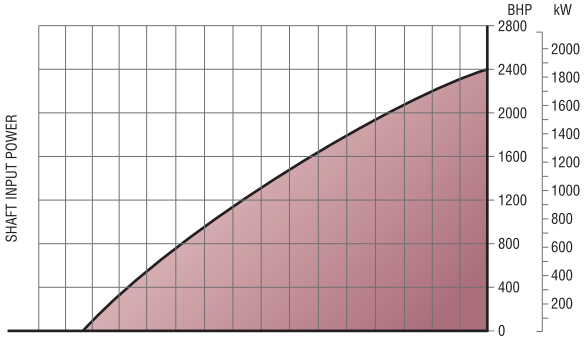
Balancing..... Military Standard 167-1 or ISO 1940
Noise Level..... OSHA 1910.95, ISO 2151:2004
Performance..... ASME PTC-10, PTC-13, ISO 5389
Hydrotesting..... API 612 @ 1.5 Times MAWP
Witness Testing Available
API 617 Option

Engineered Solutions

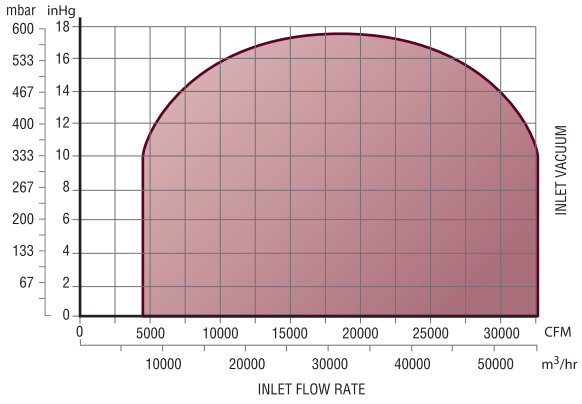
Alternative Materials - Stainless Steel, Ductile, or other
NACE Compliance for Process Gas
Special Coating or Seals
Custom Packaging to Hazardous Area Classification
Call Us Today to Discuss Your Needs

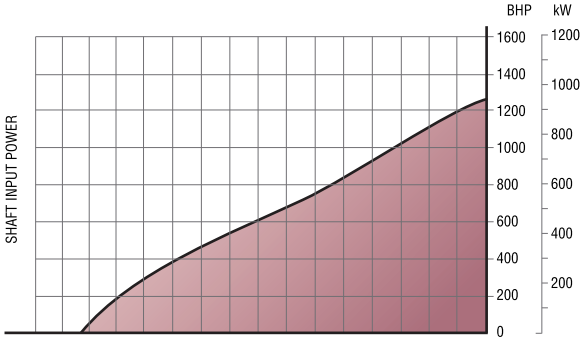
PRESSURE PERFORMANCE





EXAUSTER PERFORMANCE





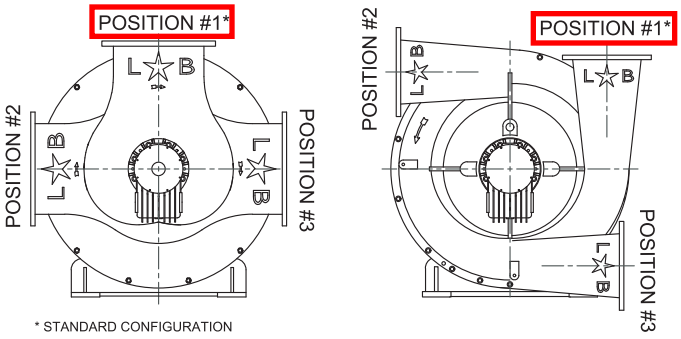
** Information is approximate and can change without notice / * Performance Based on 1 Atm, 68F/20C, 36% RH and 3550 rpm*

Lone Star Blower

LS24 Multistage Turbo

INLET & OUTLET ORIENTATION OPTIONS

The orientation of the inlet and outlet is selectable from any of the three different positions, as viewed when facing the exterior of the part:



* STANDARD CONFIGURATION

	Weight*		Wk^2	
Model	LB	Kg	LB-ft^2	Kg-m^2
LS24-1	10,600	4,808	74	3.12
LS24-2	12,700	5,761	126	5.31
LS24-3	14,900	6,759	179	7.54
LS24-4	17,300	7,847	232	9.78
LS24-5	18,900	8,573	284	11.97
LS24-6	21,100	9,571	337	14.2

Approximate weight for blower only.

LONE STAR BLOWER

+1 832 532 3112
+1 832 532 3115 Fax
info@lonestarblower.com
www.lonestarblower.com

SECTION 2.4

PERFORMANCE DATA

Lone Star Blower
8883 West Monroe
Houston, TX 77061

PH: 832-532-3112
FAX: 832-532-3115

Compressor Performance Datasheet

Customer	: Brownsville	Quote number	:
Customer reference	: Robindale WWTP	Size	: LS24
Item number	: Default	Stages	: 5
Service	:	Based on curve number	: MLS24-I115-5
Quantity	: 1	Date last saved	: 22 Sep 2020 10:04 AM
		Impeller	: 115

Operating Conditions

Standard conditions : (14.70 psi.a , 68.00 deg F , 36.00 %)

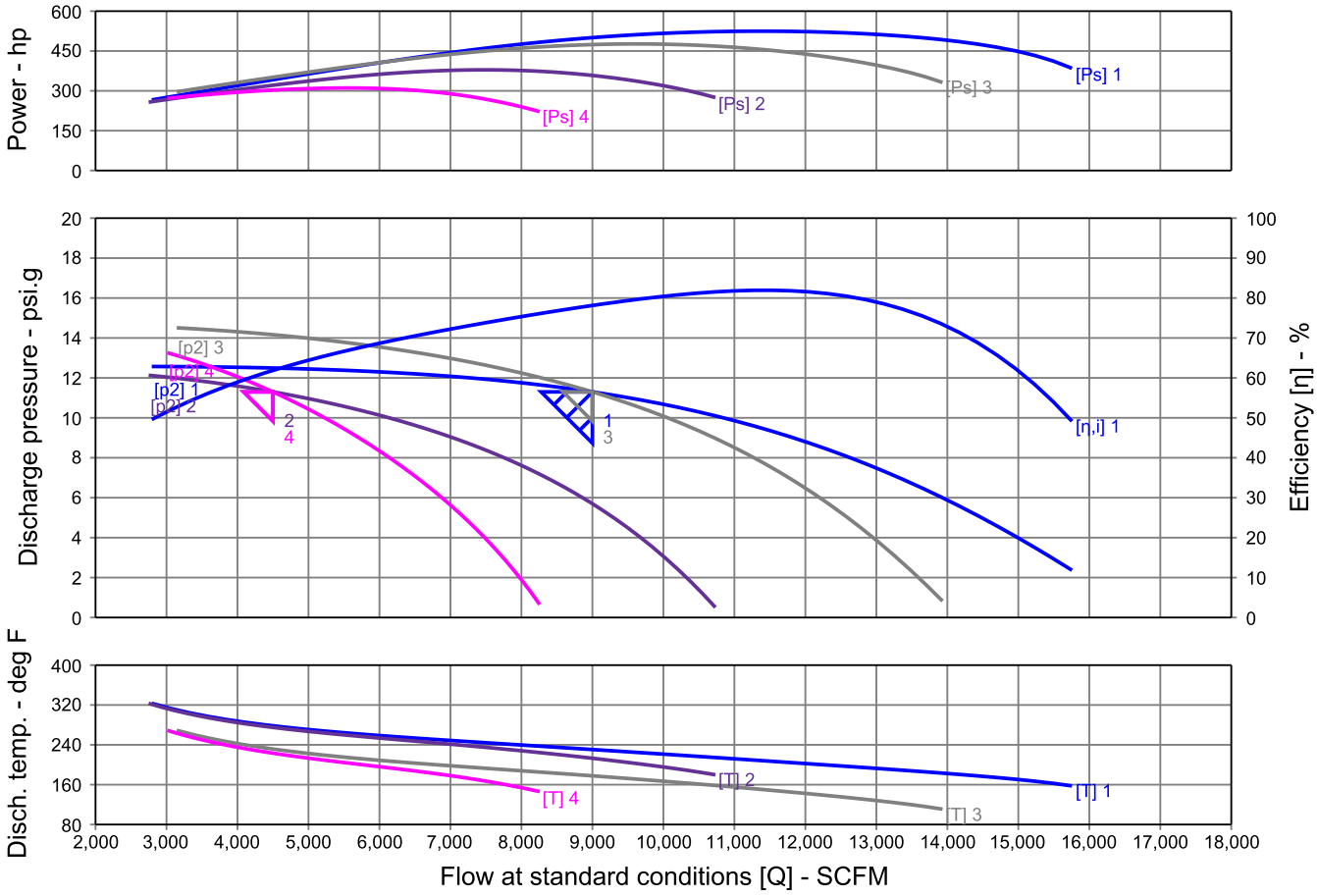
Condition		1	2	3	4		
System inlet volume flow	CFM	9,668.1	4,834.0	8,504.9	4,252.4		
Flow at standard conditions	SCFM	9,000.0	4,500.0	9,000.0	4,500.0		
Mass flow	lbm/s	11.24	5.62	11.24	5.62		
Mass flow, dry	lbm/s	10.96	5.48	11.24	5.62		
System inlet temperature	deg F	100.0	100.0	40.00	40.00		
System inlet pressure	psi.g	0.00	0.00	0.00	0.00		
Inlet pressure loss	psi	0.30	0.30	0.30	0.30		
Compressor discharge pressure	psi.g	11.30	11.30	11.30	11.30		
Discharge pressure loss	psi						
System discharge pressure [p2]	psi.g	11.30	11.30	11.30	11.30		
Compressor differential pressure	psi	11.62	12.23	12.75	13.27		
System differential pressure [dp]	psi	11.30	11.30	11.30	11.30		
Atmospheric pressure	psi.a	14.68	14.68	14.68	14.68		
Elevation above sea level	ft	30.00	30.00	30.00	30.00		
Site Supply Frequency	Hz	60	60	60	60		
Type of gas		Air	Air	Air	Air		
Relative humidity	%	60.00	60.00	0.00	0.00		
Molecular weight (MW)		28.54	28.54	28.97	28.97		
Specific heat (Cp)	Btu/(lb.deg F)	0.2464	0.2464	0.2401	0.2401		
Ratio of specific heat (k)		1.39	1.39	1.40	1.40		

Performance

Quantity of units operating		1	1	1	1		
Speed	rpm	3550	3550	3550	3550		
System discharge pressure (actual) [p2]	psi.g	11.30	11.30	11.30	11.30		
Inlet throttling applied		Yes	Yes	Yes	Yes		
Efficiency, polytropic [#,p]	%	79.86	66.05	79.11	65.34		
Efficiency, total	%	-	-	-	-		
Power, shaft [Ps]	hp	500	321	474	303		
Temperature rise	deg F	130.6	174.9	137.8	183.2		
Discharge temperature	deg F	230.6	274.9	177.8	223.2		
Rise to surge	psi	1.27	0.83	3.21	1.96		
Turndown	%	68.97	38.93	65.06	33.05		
Surge pressure	psi.g	12.57	12.13	14.51	13.26		
Surge flow	SCFM	2,792.3	2,748.1	3,144.3	3,012.7		

Compressor Performance Datasheet

Customer	: Brownsville	Quote number	:
Customer reference	: Robindale WWTP	Size	: LS24
Item number	: Default	Stages	: 5
Service	:	Based on curve number	: MLS24-I115-5
Quantity	: 1	Date last saved	: 22 Sep 2020 10:04 AM
		Impeller	: 115



Compressor Performance Datasheet

Customer	: Brownsville	Quote number	:
Customer reference	: Robindale WWTP	Size	: LS24
Item number	: Default	Stages	: 5
Service	:	Based on curve number	: MLS24-I115-5
Quantity	: 1	Date last saved	: 22 Sep 2020 10:04 AM
		Impeller	: 115

Operating Conditions

Standard conditions : (14.70 psi.a , 68.00 deg F , 36.00 %)

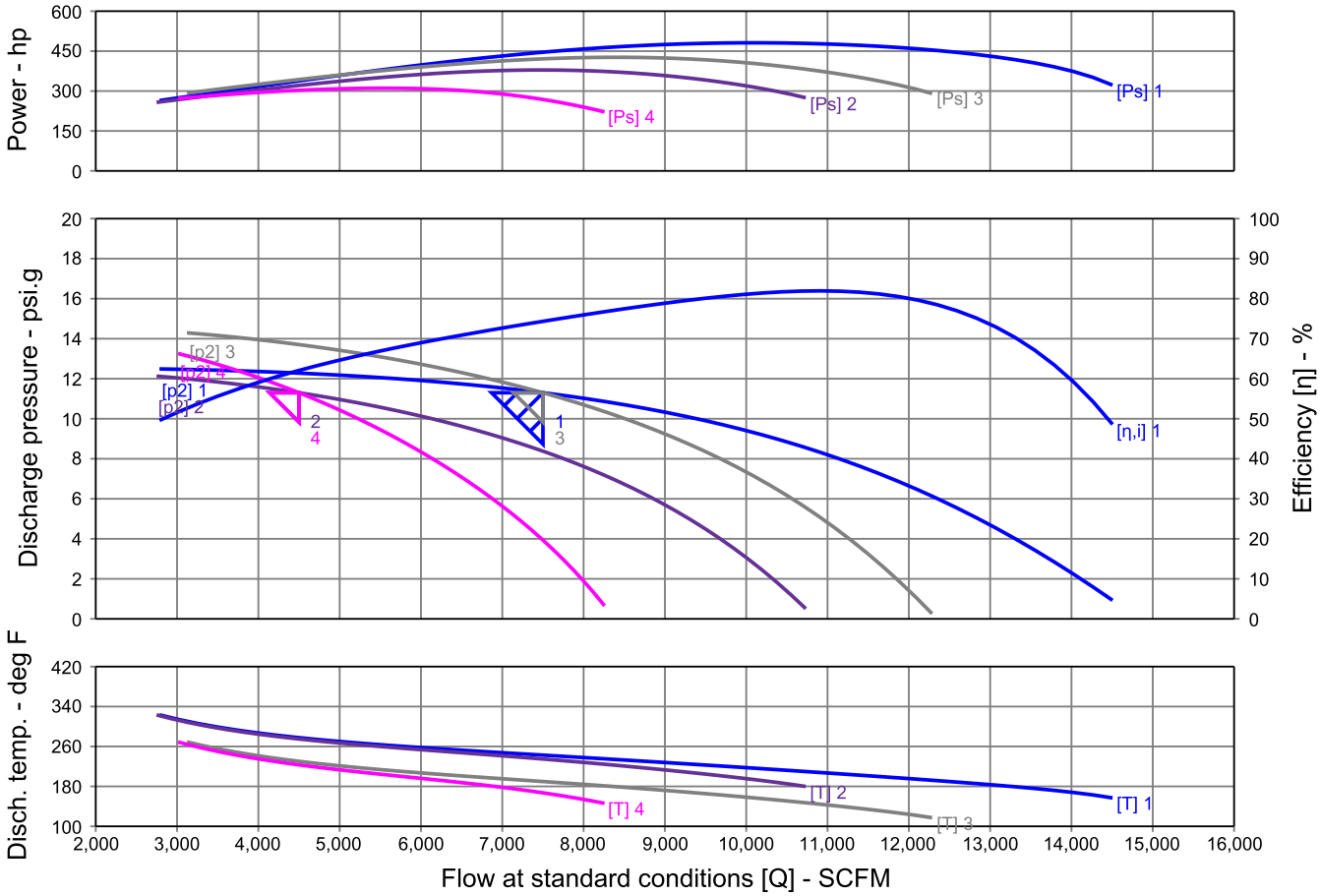
Condition		1	2	3	4		
System inlet volume flow	CFM	8,056.7	4,834.0	7,087.4	4,252.4		
Flow at standard conditions	SCFM	7,500.0	4,500.0	7,500.0	4,500.0		
Mass flow	lbm/s	9.37	5.62	9.37	5.62		
Mass flow, dry	lbm/s	9.14	5.48	9.37	5.62		
System inlet temperature	deg F	100.0	100.0	40.00	40.00		
System inlet pressure	psi.g	0.00	0.00	0.00	0.00		
Inlet pressure loss	psi	0.30	0.30	0.30	0.30		
Compressor discharge pressure	psi.g	11.30	11.30	11.30	11.30		
Discharge pressure loss	psi						
System discharge pressure [p2]	psi.g	11.30	11.30	11.30	11.30		
Compressor differential pressure	psi	11.93	12.23	13.01	13.27		
System differential pressure [dp]	psi	11.30	11.30	11.30	11.30		
Atmospheric pressure	psi.a	14.68	14.68	14.68	14.68		
Elevation above sea level	ft	30.00	30.00	30.00	30.00		
Site Supply Frequency	Hz	60	60	60	60		
Type of gas		Air	Air	Air	Air		
Relative humidity	%	60.00	60.00	0.00	0.00		
Molecular weight (MW)		28.54	28.54	28.97	28.97		
Specific heat (Cp)	Btu/(lb.deg F)	0.2464	0.2464	0.2401	0.2401		
Ratio of specific heat (k)		1.39	1.39	1.40	1.40		

Performance

Quantity of units operating		1	1	1	1		
Speed	rpm	3550	3550	3550	3550		
System discharge pressure (actual) [p2]	psi.g	11.30	11.30	11.30	11.30		
Inlet throttling applied		Yes	Yes	Yes	Yes		
Efficiency, polytropic [#,p]	%	76.43	66.05	75.69	65.34		
Efficiency, total	%	-	-	-	-		
Power, shaft [Ps]	hp	446	321	421	303		
Temperature rise	deg F	142.7	174.9	149.7	183.2		
Discharge temperature	deg F	242.7	274.9	189.7	223.2		
Rise to surge	psi	1.19	0.83	3.00	1.96		
Turndown	%	62.88	38.93	58.38	33.05		
Surge pressure	psi.g	12.49	12.13	14.30	13.26		
Surge flow	SCFM	2,784.1	2,748.1	3,121.7	3,012.7		

Compressor Performance Datasheet

Customer	: Brownsville	Quote number	:
Customer reference	: Robindale WWTP	Size	: LS24
Item number	: Default	Stages	: 5
Service	:	Based on curve number	: MLS24-I115-5
Quantity	: 1	Date last saved	: 22 Sep 2020 10:04 AM
		Impeller	: 115



SECTION 2.5

LUBRICANT

Lone Star Blower

Starlube® Synthetic Lubricants

***Starlube*® Synthetic Lubricants are specifically designed to ensure maximum reliability and superior performance for geared and multistage turbo technologies.**

Proper maintenance coupled with using prescribed lubricants is crucial to protecting your investment and the long-term reliability of your equipment. As a blower manufacturer, we can recommend the proper lubricants to use in any application or environment.

Geared Turbo Synthetic Oil

SO-INFINITY Offers more than 90,000 hours of maximum protection. A true Group V PAG synthetic oil, there is nothing better to last longer, run cooler, and protect against any possible varnishing.

SO-32 A Group III synthetic oil offering protection twice as long any as petroleum base lubricants and can upgrade your current installation.

Multistage Turbo Synthetic Oil and Grease

SO-46 A Group III synthetic oil for standard applications with superior rust and anti-oxidation properties combined with a great emulsifier of any condensation.

SO-150 Similar to **SO-46**, but for higher temperature applications.

SG-100 Synthetic grease offers extreme anti-corrosion and anti-oxidant characteristics to enhance its performance at higher speeds, heavy loads and at high temperatures.

Choose our **FO-100** oil and **FG-100** grease for applications with food grade requirements.

Lone Star Blower

Starlube® Synthetic Lubricants

Starlube® Turbo Oil	Multistage Turbo			Geared Turbo	
	SO-46	SO-150	FO-100	SO-32	SO-INFI
Standard Run Hours*	8000	8000	6000	16000	90000+
Sythetic Group Type	3 SH	3 SH	3 SH	3 SH	5 PAG
Color, Visual	Red	Purple	White	Blue	Gold
Viscosity cSt@ 40°C ASTM D445	46	150	100	32	25
Viscosity index ASTM D2270	129	127	128	129	165
Pour point °C ASTM D97	-24	-20	-21	-27	-48

Starlube® Grease	Multistage Turbo	
	SG-100	FG-100
Standard Run Hours*	8000	6000
NLGI Grade ASTM D217	2	2
Color, Visual	Blue	White
Thickener Type Complex	Lithium	Aluminium
Penetration 25°C, ASTM D217	285	285
Viscosity cSt@40°C ASTM D445	100	130

Note: We supply oil in quart, gallon, five gallon, and 55 gallon increments. Grease is supplied in 15 ounce tubes.

Our Lone Star Oil Sample Kit provides everything you need to take a sample of your oil and receive a detailed report of the analysis.

Each kit contains a carrying case, hand oil pump, tubing, sample jars that attach to the pump, shipping container, pre-paid postage envelope, and includes the cost of the analysis that will be sent to you and the factory for review.

**Oil and Grease should be changed when required. This is accomplished by sampling and determining the maintenance interval. • Never mix lubricants or over fill. • Consult your Operations and Maintenance manual for instructions.*

LONE STAR BLOWER
+1 832 532 3112 Office
+1 832 532 3115 Fax
info@lonestarblower.com
www.lonestarblower.com

SECTION 3

MAIN DRIVE MOTORS

SECTION 3.1

MOTOR DATA SHEET

Lone Star Blower
8883 West Monroe
Houston, TX 77061

PH: 832-532-3112
FAX: 832-532-3115

GE INDUSTRIAL MOTORS
a WOLONG company

Product Technical Information

July 10, 2020

Data shown is for the current revision model #. Ensure your nameplate model # matches.

Model Number:	**5KS513SAA145B**
Catalog Number:	**Q544**
Instruction Manual:	GEI-56128
Connection Diagram:	GEM2034E-FIG20
Outline Drawing:	239C6C00HD

Accessory Connection Diagrams

Bearing Thermocouple:	None	**Heater:**	3027JE-1C
RTD:	None	**Thermistor:**	None
Thermostat:	None	**Winding Thermocouple:**	None
Bearing RTD:	None		

Table of Contents

Marks:

MODEL NUMBER:	**5KS513SAA145B**	**Estimated Weight:**	6917 Lbs
Outline Drawing:	239C6C00HD	**Time Rating:**	CONT
Connection Diagram:	GEM2034E-FIG20	**Enclosure:**	TEFC
Instruction Book:	GEI-56128	**Encl Construction:**	SD
Design Code:	50BD0287A	**Ambient Max(°C):**	40
Type:	KS	**Alt Ambient Max(°C):**	--
Frame:	5013ST	**Insulation Class:**	F
Phases:	3	**NEMA Design:**	--
Poles:	2	**Nominal Efficiency:**	96.2 %
Output Power:	600HP 444KW	**Guaranteed Efficiency:**	95.4 %
RPM:	3575	**3/4 Load Efficiency:**	--
Voltage:	460	**KVA Code:**	H
Hertz:	60	**Max KVAR:**	67.2
Amps - FL:	614.0	**Power Factor:**	95.0
Service Factor:	1.15	**Bearing - DE:**	6315ZC3
Alt Service Factor:	--	**Bearing - ODE:**	6315ZC3

Enclosure is Totally Enclosed Fan-Cooled

Stamped Nameplate Notes:

TEMP CONT HTR LDS HE1-HE2 115V 200W
ROT CW FACING ODE LEAD/PH SEQUENCE 1-2-3/1-2-3
MAX SPACE HEATER SURFACE TEMPERATURE 160C
STAMP NP249A5564P075 AS BELOW:
MODEL:5KS513SAA145B
SN: XXX CSA CERTIFIED CSA.09.2216219
FOR CL I DIV2 GRP A,B,C,D T3 IN -40C<= TAMB<= 40C
1.0SF ON SINE-WAVE PWR OR ALTERNATE RATING
TEMP CODE T2D AT 1.15 SF ON SINE-WAVE PWR
OR -- VT PWM CONTROL 1.0 SF -- C AMB VT -- HZ.
FOR DIRECT COUPLED LOAD ONLY

Additional Information:

2P - ST EXTN - SPLIT LEAD
C/BOX 5700 CU IN - 3(3.00" NPT)
C/B GRD PLATE
OIL RESISTANT SLEEVING ON LEADS
115V TSTAT CTRLD HTR LDS TO AUX BOX W/ TERM BOARD OPP C BOX
SPACE HEATER CAUTION NAMEPLATE
BEARING RTD PROVISION ON BOTH ENDS
NEMA TYPE GRD PAD
F1 MOUNTING
I-ALERT MOUNTED ON DE ENDSHIELD

Formal Data Pack to be provided upon project release.

Motor Adders:

- Ambient Temperature - High (Deg C)- 50
- Service Factor- 1.15
- Nameplate, phase seq. & dirn of rotn.
- Nameplate, phase seq. & rotn arrow
- Accessory Box for RTD leads
- Brg. Temp. Detector -100 Ohm Platinum, Qty & Location (Detector) -1 In Each End
- Space Heater Type-Standard110 - 120 V
- Burndy Hydent Lead Terminals
- Resist. Temp. Detectors -Set Of 6 100 Ohm Platinum
- Provision for mounting vibration device at each end-Customer to furnish dimensions.
- Self-balancing differential CT
- Main terminal box-11500Cu inch
- Vibration Sensors

Model Number:5KS513SAA145B	July 10, 2020

Performance Characteristics 1st Winding 1st Connection **Design: 50BD0287A**

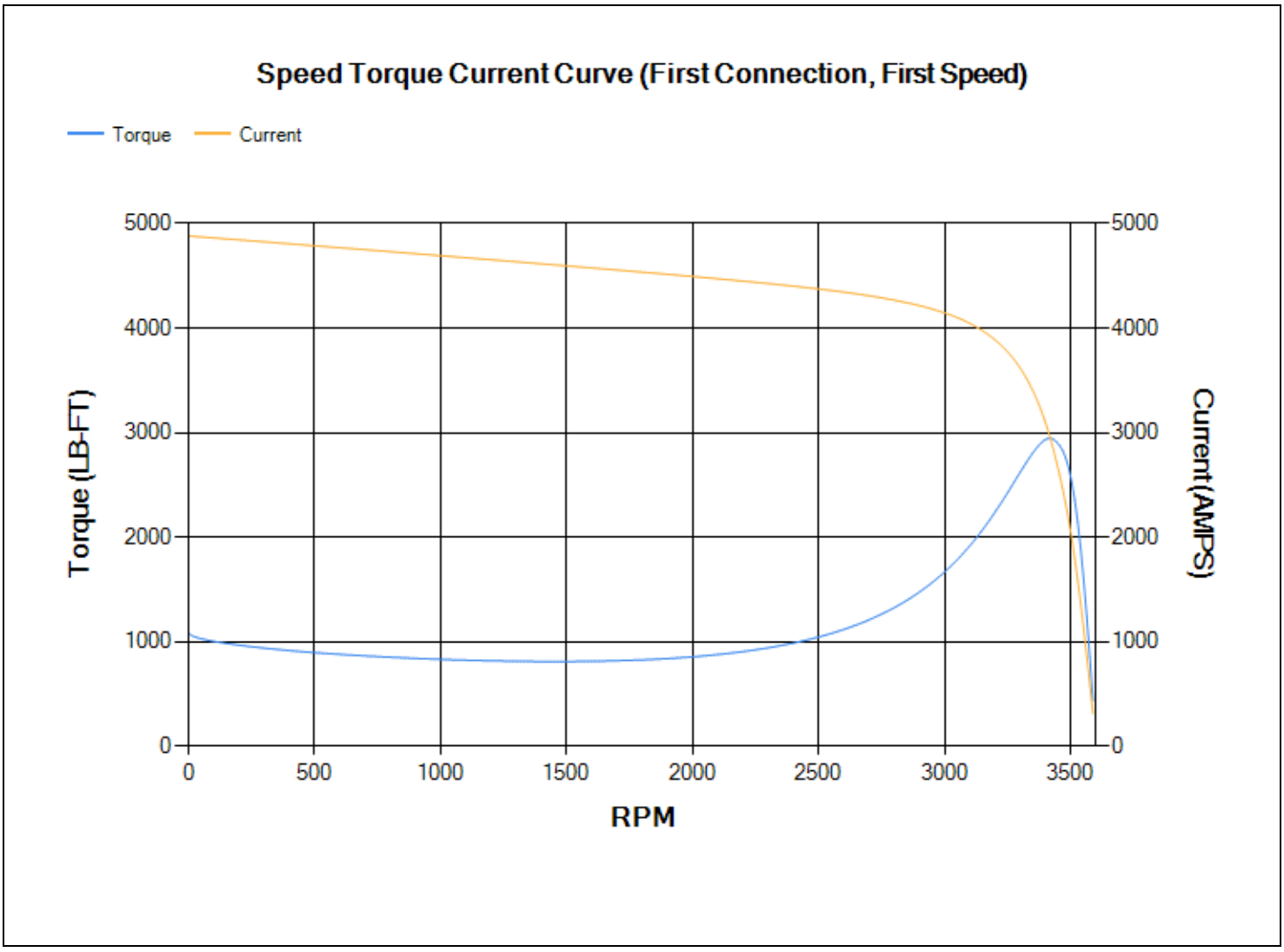
Marks:

LOAD %	125.0	115.0	100.0	75.0	50.0	25.0	0.0
% EFF	96.03	96.2	96.61	96.6	96.39	94.7	0.00
% PF	94.82	94.95	95.02	94.54	92.35	82.24	6.88
AMPS	770.9	707	611.02	461.15	315.42	180.26	93.77

TORQ(FL)#FT	881.44	**TORQ(LR)%FL**	123.39	**TORQ(BD)%FL**	333.75
AMPS(LR)	4881.82	**PF AT START**	0.17		

This motor is capable of two cold or one hot start with a maximum connected load inertia of 1610 Lb-Ft Sq (67.78 Kg-meter Sq)at 100% voltage, where the load torque varies with the square of the speed. Acceleration time with maximum inertia and the above load type is 24 seconds. Safe stall time at 100% voltage is 46 seconds cold, 29 seconds hot. Rotor inertia is 156.68 Lb-Ft Sq (6.6 Kg-meter Sq).

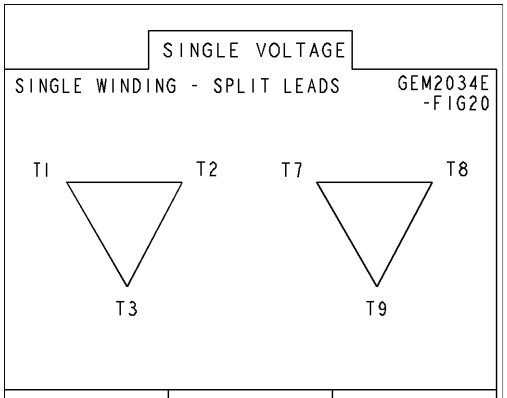
Open Circuit A-C:	2.396	**Short Circuit D-C:**	0.039
Short Circuit A-C:	0.049	**X/R Ratio:**	14.684
Stator Slots:	48	**Rotor Slots:**	40



Marks:

Connection Diagram

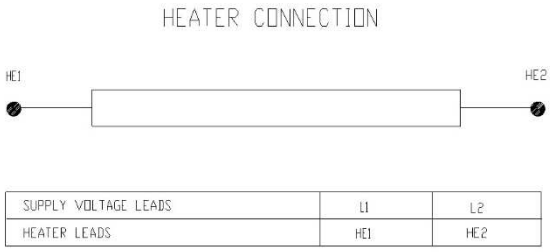
GEM2034E-FIG20



L1	L2	L3
T1-T7	T2-T8	T3-T9

Heater Connection

3027JE-1C



SUPPLY VOLTAGE LEADS	L1	L2
HEATER LEADS	HE1	HE2

Testing to be performed:

Routine test-

Every General Electric motor is tested for the parameters listed below. The routine test consists of:
a. Measurement of winding resistance.
b. Measurement of no-load current and speed at rated voltage
c. Measurement of no-load radial and axial vibration at rated voltage with the motor mounted on elastic pads.
d. High-potential test per NEMA MG1, Part 3.
Note: On motors rated at other than 60 Hz, measurements may be taken at 60 Hz.

Complete test-

A complete test consists of the following items:
a. High-potential testing
b. Winding temperature rise by resistance at rated load under dynamometer loading
c. Speed at 100, 75, 50, and 25% of rated load
d. Efficiency at 100, 75, 50, and 25% of rated load
e. Power factor at 100, 75, 50 and 25% of rated load
f. Input current at 100, 75, 50 and 25% of rated load
g. Input power at 100, 75, 50 and 25% of rated load
h. Locked-rotor current (at rated voltage or by calculation from a test at reduced voltage)
i. Locked-rotor torque (at rated voltage or by calculation from a test at reduced voltage)
j. Breakdown torque (at rated voltage or by calculation from a test at reduced voltage)

End shield Assembly		
Part Description	DE Side Part#	ODE Side Part#
End Shield	115E5200CX1	115E5200AD1
Bearing	235A2513AG01	235A2513AG01
Slinger/Inproseal	149C4399G13	149C4399G10

Fan & Fan Cover Assembly	
Part Description	Part#
Fan	148C8070AA1
Fan Cover	119D3661AA2

Conduit & Accessories Box Assembly	
Part Description	Part#
Conduit Box	179B9048AV-G03

Mechanical Accessories	
Part Description	Part#
Brake	
Tachometer	

SECTION 3.2

MOTOR DRAWING

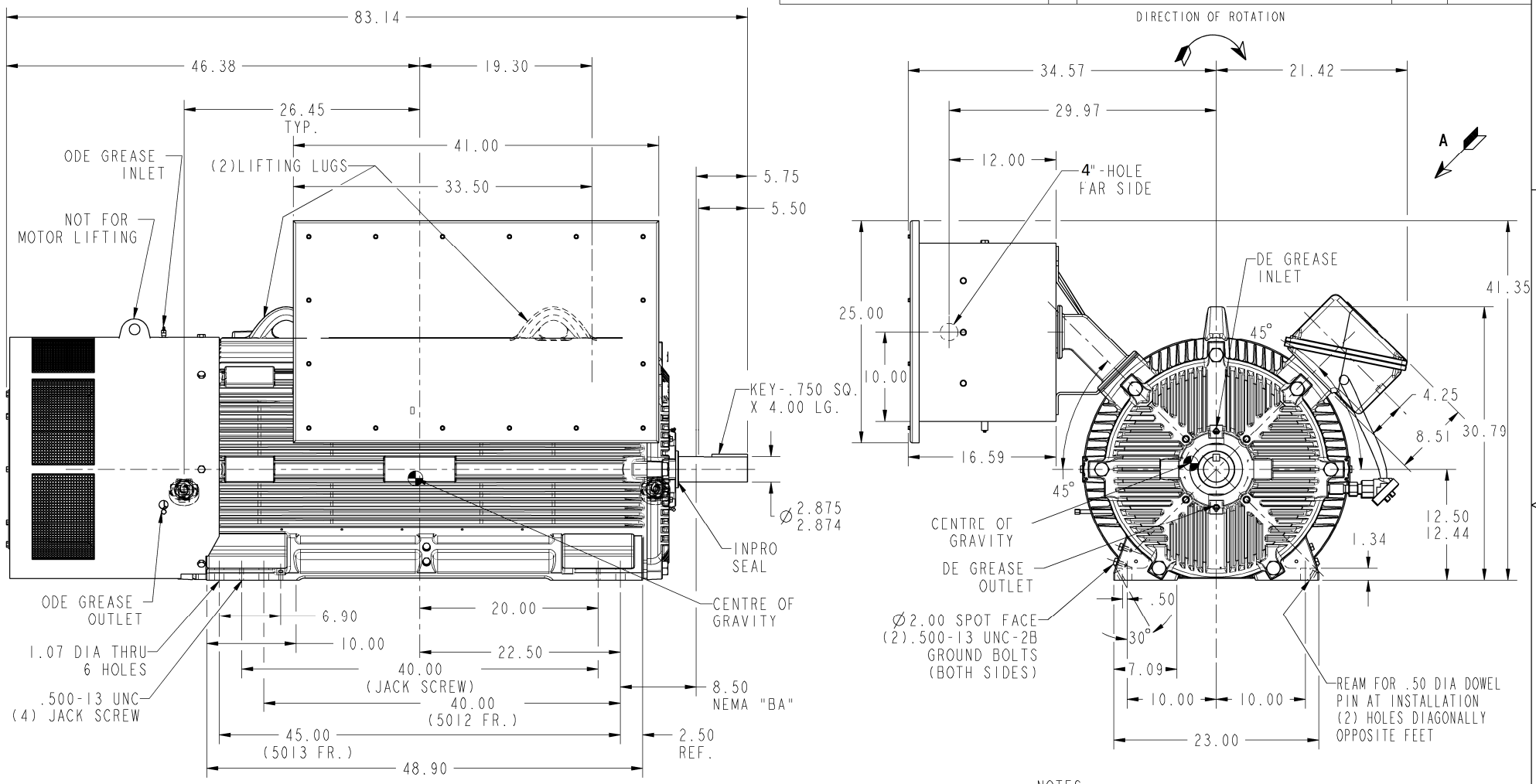
Lone Star Blower
8883 West Monroe
Houston, TX 77061

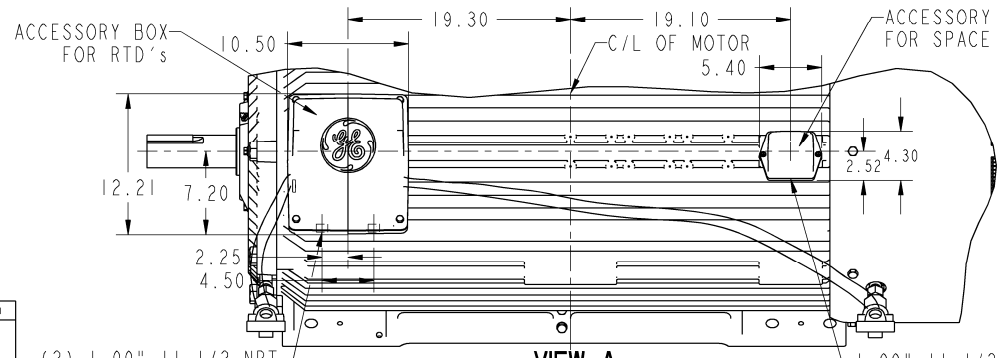
PH: 832-532-3112
FAX: 832-532-3115

SIZE	DRAWING NO.	REV	SHEET
C	239C6C00VW	002	1

REVISIONS

REV.	DESCRIPTION		DATE	APPROVED
1	ISAAC #20-0430	SANTOSH C	4/26/2020	RAGHU
2	ISAAC #20-0499	SANTOSH C	5/15/2020	RAGHU





VIEW A

NOTES:
1. F-1 ASSEMBLY AS SHOWN.
2. ALL DIMENSIONS ARE IN INCHES.
3. TOLERANCE PERMISSIBLE ON SHAFT EXTENSION RUNOUT IS .0015 T.I.R.

SIGNATURES		DATE
MODEL	BHARATH	01/30/2020
DETAIL	BHARATH	01/30/2020
CHECKED	RAGHU	01/30/2020
ENGRG	SANTOSH	01/30/2020
MFG	.	.
QUALITY	.	.
ISSUED	BHARATH	01/30/2020

SOLID MODEL: 239C6C00VW

GE INDUSTRIAL MOTORS
a WOLONG company

TITLE
OUTLINE
QUANTUM 5012/5013ST TEFC
11500 CU. IN. CONDUIT BOX, BTD TO ACC. BOX

SIZE	DRAWING	REV
C	239C6C00VW	002

SCALE: 0.120 | REF. No: 239C6C00NL | SHEET 1 OF 1

THIRD ANGLE PROJECTION

SECTION 4

ACCESSORIES

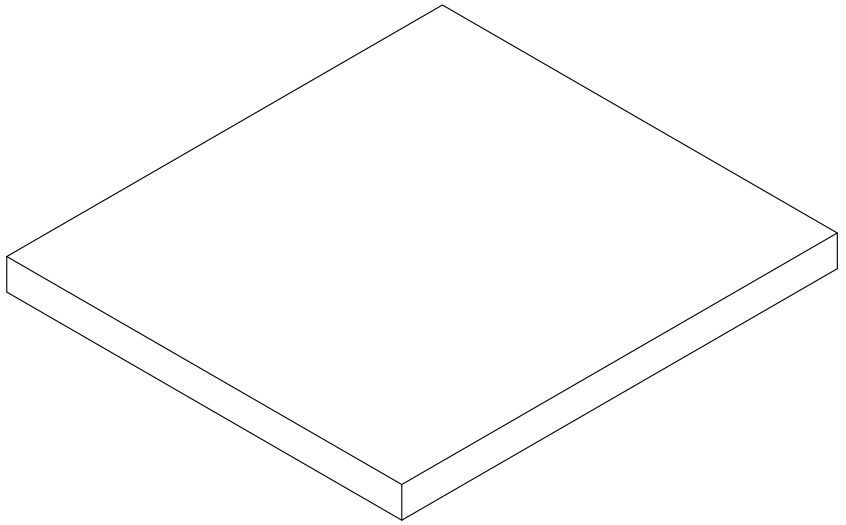
SECTION 4.1

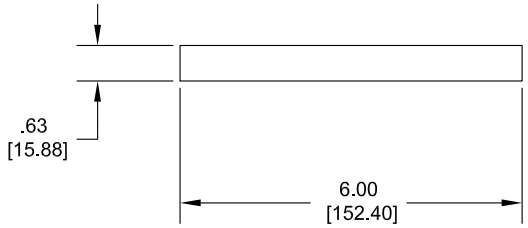
VIBRATION ISOLATION PADS

Lone Star Blower
8883 West Monroe
Houston, TX 77061

PH: 832-532-3112
FAX: 832-532-3115

REVISION HISTORY			
REV	DESCRIPTION	DATE	APPROVED





PART NUMBER	MATERIAL
1000964000	NEOPRENE 60D

UNLESS OTHERWISE SPECIFIED
DO NOT SCALE

THIRD ANGLE PROJECTION

DRAWING IS FOR REFERENCE ONLY
UNLESS SPECIFIED AS RELEASED.

APPROVALS		
DRAWN	JC	08/26/2016
CHECK		
ENGINEER		
MANUFACTURING		
CONTROL		
APPROVED	GB	05/21/2019

LONE STAR BLOWER

TITLE
PAD, VIBRATION ISOLATION
6x6x5/8

SIZE	CAGE CODE	DWG NUMBER	REV
A	-	1008000044	0
SCALE		SHEET 1 OF 1	

SECTION 4.2

COUPLING

Lone Star Blower
8883 West Monroe
Houston, TX 77061

PH: 832-532-3112
FAX: 832-532-3115

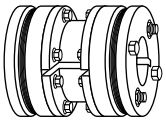
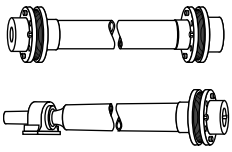
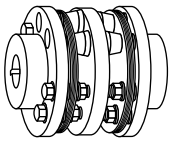
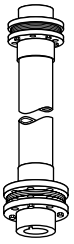
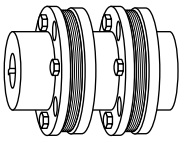
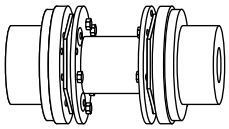
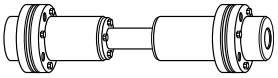
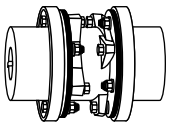
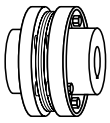
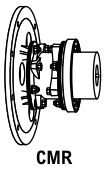
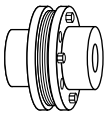
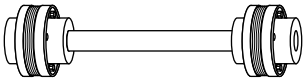
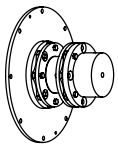
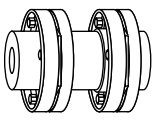
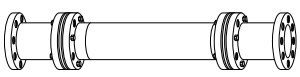
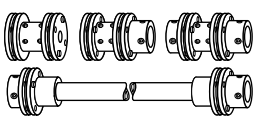
Disc Coupling Catalog

Download the most up-to-date version
at www.rexnord.com/documentation

Thomas Flexible Disc Couplings

(Inch)

Rexnord Thomas Coupling Application Guide

Coupling Type	Typical Applications	Coupling Type	Typical Applications
 Series 54RDG	Close-coupled applications. Suitable as replacement for gear and grid couplings.	 SN SF	Turbines, pumps, compressors, test stands, generators, speed increasers, fans (cooling tower, mine ventilating, forced and induced draft), paper mill drives, line shafts, printing machines, pumps. Available as a standard in corrosion-resistant materials.
 DBZ, DBZ-A, DBZ-B	Mixers, compressors, agitators, blowers and fans, centrifugal pumps, conveyors.	 SV	Vertical drives such as sewage pumps, printing machines, marine pumps. Available as a standard in corrosion-resistant materials.
 Series XTSR52	Pumps and compressors (centrifugal, rotary, lobe and axial), speed increasers, fans, dynamometers.		
 Series XTSR71	Pumps and compressors with popular shaft separation standards, blowers, fans, speed increasers.	 Adjustable Length SN	Same applications as SN but where axial and/or angular adjustment is desired.
 AMR	Reciprocating pumps and compressors, fan drives, blowers, heavy-duty industrial drives, crushers, extruders, hoists, dredges, generators, chippers, calenders, mill drives, conveyors.	 ST	Accommodates angular misalignment only. Three-bearing applications where radial load is supported by the coupling, such as single-bearing generators, V-belt sheaves, etc.
 CMR	Engine drivers, reciprocating pumps and compressors, heavy-duty industrial drives where flywheel mounting is required.	 SN Single	Accommodates angular misalignment only. May be used with intermediate solid shaft for applications similar to BMR, but with high speed capacity. Available in corrosion-resistant materials.
 BMR	Blowers, fans, crushers, marine drives, dredge pumps, hoists, heavy-duty industrial drives, reciprocating pumps and compressors, paper mill drives, conveyors	 THP	Turbines, pumps, compressors, speed increasers, test stands.
 Series 44	Engine drivers, reciprocating pumps and compressors, heavy-duty industrial drives where flywheel mounting is required.	 Series 63	Turbines, pumps, compressors, test stands, generators, speed increasers.
 SN-GA	Pulp and paper machines, line shafts, pelletizers, crushers and mill drives. Replacing long span gear couplings, bolting to existing rigid hubs.	 Miniature Couplings	Tachometers, encoders, switches, ball screws, test stands, pumps, compressors, centrifuges, theodolites, sonar, radar, scales, carburetors.

NOTE: Dimensions subject to change. Certified dimensions of ordered material furnished on request.

Rexnord Thomas Flexible Disc Couplings

Thomas XTSR71 Spacer Type Series Coupling with Adapter

The optimized 3-piece design allows for the smallest possible package for an application. The hubs are pilot fitted to the factory assembled center member. The design allows for repeatable installations without special tooling. Additional modifications may be made to reduce coupling weight, or special mountings to make it an economical option on various critical and high speed applications. Common engineered solutions are available such as torque overload protection, electrically insulated, spark resistant and alloy construction.

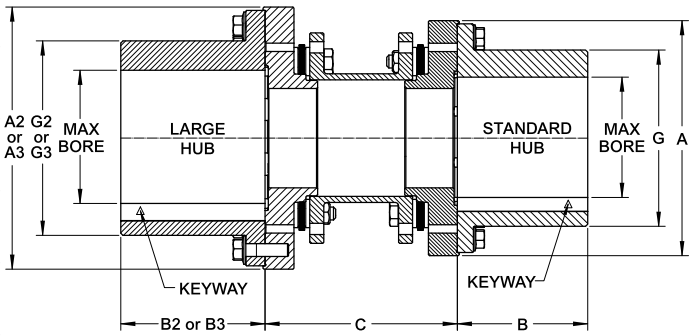
The XTSR71 couplings are designed for spacer type coupling critical applications including API applications. The XTSR71 couplings are API 610, ISO 10441, ISO 14691 compliant when specified, and ATEX II 2GD c T6 certified. Common applications include motor and turbine driven pumps, compressors, fans, synchronized rollers, wire feeders and blowers.

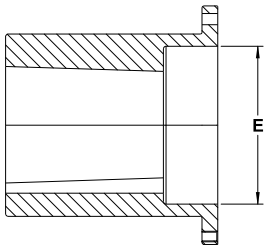
Construction

Hubs and Center assembly: Carbon steel
Bolts: Alloy steel
Disc Packs: Stainless steel. Max misalignment is 1/2° per disc pack for sizes 726 to 996 and 1/3° per disc pack for sizes 1088 to 5258.
Coatings Available: Manganese Phosphate provided as standard. Other coatings available upon request.

General Coupling Data

Size	Max.Cont. Torque (lb•in) ⑤	③ Std Hub Max. Bore	③ XL Hub Max. Bore	③ XXL Hub Max. Bore	Min. C (in)	Max. C (in)	Max. Speed (rpm) ④ Not Balanced	Max. Speed (rpm) Balanced	① Axial Capacity (in)	Max Counter Bore E (in)
726	2,630	1.63	2.00	2.38	2.56	15.66	12,000	20,000	±0.05	2.08
826	4,900	2.00	2.38	2.88	3.03	15.87	10,900	18,500	±0.06	2.58
996	8,210	2.38	2.88	3.38	3.62	32.18	9,800	15,000	±0.07	3.03
1088	19,400	2.88	3.38	4.00	3.78	32.21	9,000	14,000	±0.05	3.47
1298	31,400	3.38	4.00	4.50	4.53	32.56	8,000	12,000	±0.06	4.13
1548	52,300	4.00	4.50	5.00	5.31	32.95	7,100	10,000	±0.07	4.86
1698	72,500	4.50	5.00	5.50	5.94	33.46	6,600	9,100	±0.08	5.60
1928	98,200	5.00	5.50	6.00	6.34	33.74	6,100	8,500	±0.09	6.17
2068	136,000	5.50	6.00	6.50	7.36	46.30	5,800	7,800	±0.10	6.70
2278	176,000	6.00	6.50	7.75	7.72	46.54	5,500	7,100	±0.11	7.42
2468	232,000	6.50	7.75	8.63	8.23	46.85	5,200	6,500	±0.12	7.85
2698	318,000	7.75	8.63	9.13	9.29	47.32	4,800	6,000	±0.13	9.69
2888	416,000	8.63	9.13	10.00	10.04	47.72	4,600	5,700	±0.14	10.69
3058	461,000	9.13	10.00	11.00	10.12	47.99	4,400	5,400	±0.15	11.73
3358	622,000	10.00	11.00	11.50	11.30	48.66	4,200	4,700	±0.16	12.37
3668	834,000	11.00	11.50	12.25	12.20	48.94	3,900	4,400	±0.17	13.97
3908	909,000	11.50	12.25	14.00	12.24	49.09	3,800	4,100	±0.19	14.85
4178	1,130,000	12.25	14.00	15.00	13.39	49.92	3,600	3,900	±0.20	15.64
4588	1,670,000	14.00	15.00	16.00	15.20	46.69	3,400	3,600	±0.22	17.72
4918	2,080,000	15.00	16.00	–	16.06	47.15	3,200	3,300	±0.23	19.21
5258	2,510,000	16.00	–	–	17.24	47.96	3,100	3,100	±0.25	20.19





Size	Std A (in)	XL A2 (in)	XXL A3 (in)	Std B (in)	XL B2 (in)	XXL B3 (in)	Std G (in)	XL G2 (in)	XXL G3 (in)	② Std Weight (lb)	Weight Change Per in of "C" (lb/in)	② WR^2 (lb•in²)
726	3.74	4.25	5.08	1.38	1.65	2.01	2.32	2.87	3.39	6.83	0.174	12.4
826	4.25	5.08	5.51	1.65	2.01	3.23	2.87	3.39	4.09	11.0	0.300	26.3
996	5.08	5.51	6.54	2.01	3.23	3.74	3.39	4.09	4.84	18.5	0.281	64.2
1088	5.51	6.54	7.83	3.23	3.74	4.49	4.09	4.84	5.71	27.6	0.541	115
1298	6.54	7.83	8.66	3.74	4.49	4.80	4.84	5.71	6.50	45.4	0.661	272
1548	7.83	8.66	9.66	4.49	4.80	5.31	5.71	6.50	7.17	76.3	0.901	646
1698	8.66	9.66	10.39	4.80	5.31	6.10	6.50	7.17	7.87	104	1.20	1090
1928	9.66	10.39	11.44	5.31	6.10	6.57	7.17	7.87	8.66	138	1.40	1820
2068	10.39	11.44	12.32	6.10	6.57	7.48	7.87	8.66	9.29	187	1.82	2870
2278	11.44	12.32	13.58	6.57	7.48	7.28	8.66	9.29	11.02	243	2.11	4440
2468	12.32	13.58	15.00	7.48	7.28	7.87	9.29	11.02	12.13	315	2.52	6630
2698	13.58	15.00	15.94	7.28	7.87	7.52	11.02	12.13	13.07	406	3.20	11300
2888	15.00	15.94	17.20	7.87	7.52	8.86	12.13	13.07	13.98	567	4.01	18300
3058	15.94	17.20	18.98	7.52	8.86	10.12	13.07	13.98	15.67	604	4.05	23200
3358	17.20	18.98	19.80	8.86	10.12	9.80	13.98	15.67	16.50	807	5.08	35500
3668	18.98	19.80	20.83	10.12	9.80	10.47	15.67	16.50	17.48	1150	6.23	60100
3908	19.80	20.83	23.94	9.80	10.47	11.81	16.50	17.48	19.84	1180	6.21	71400
4178	20.83	23.94	25.51	10.47	11.81	12.60	17.48	19.84	21.46	1430	7.28	96000
4588	23.94	25.51	26.69	11.81	12.60	13.62	19.84	21.46	22.64	2190	10.0	185000
4918	25.51	26.69	–	12.60	13.62	–	21.46	22.64	–	2650	11.8	260000
5258	26.69	–	–	13.62	–	–	22.64	–	–	3130	13.1	341000

Example Selection:

1. Select coupling size 1088 for 19,000 lb·in torque and 2.5in pump shaft diameter.
2. Select XXL 2nd hub for 3.5in motor shaft diameter.
3. Therefore, coupling is a 1088 XTSR71 XXL.

A 1088 XTSR71 XXL has one hub with 2.88in max bore and one hub with 4in max bore.

① All Thomas disc couplings meet NEMA frame sleeve bearing motor specifications without modification or the addition of end-float restricting devices.
② Weight and WR2 of couplings with standard adapters at maximum bore and minimum "C" dimension listed.
③ Consult Rexnord for minimum rough bore sizes.
④ XTSR71 couplings meet AGMA Class 9 balance requirements as manufactured with interference fit bore and close fit keyway. If clearance fit and/or setscrews are required, consult Rexnord.
⑤ Peak Overload Torque (lb • in) is twice the Maximum Continuous Torque.

NOTE: Dimensions subject to change. Certified dimensions of ordered material furnished on request.

Rexnord Thomas Coupling Selection

Quick Coupling Selection Procedure

The following procedure can be used to select disc couplings for most applications.

For applications involving other than normal loading in design, special considerations must be given to coupling selection. Rexnord application engineers are readily available for selection, advice and assistance.

1. Select coupling type.

   Refer to page 3 and select the type of coupling to suit your application. If an application requires a special purpose coupling, refer application details to the local Rexnord Representative.

2. Calculate operating torque of application.

   a. Use the following formula to calculate operating torque of application:

   i. $\text{Torque (lb-in)} = \dfrac{\text{Driver Horsepower} \times 63025}{\text{Operating Speed}}$

3. Determine service factor.

   a. Find application in table on page 6; use the service factor value assigned to that application.

   b. Note: if application not listed, see Load Classification Table on page 6.

   c. Note: The service factor table considers the driven equipment only and assumes a normal electric or turbine driver. For prime movers of the reciprocating type (engines, etc) use the engine drive service factor adder on page 6 to the selected service factor.

4. Multiply operating torque by the selected service factor to determine minimum required torque rating of coupling.

5. Find coupling in the coupling type section of catalog that meets the minimum required torque rating.

6. Verify that the selected coupling will accommodate the shaft sizes or flywheel if engine mount, of driving and driven equipment. Shaft diameters should be equal or less than published maximum bore of selected coupling.

a. If coupling will not accommodate shaft sizes, select the next largest size that will accommodate shaft sizes.

7. Verify coupling selected can accommodate operating speed of application.

8. Check limiting data.

   a. Other data in coupling type section of catalog can be used to verify that selected coupling will work in application. Additional data can help verify application envelope of space, weight and WR^2 considerations.

IMPORTANT NOTE:
The coupling selection criteria is intended for the determination of the coupling and style only. It is also recommended that the system be analyzed for torsional and lateral stability using the specific mass elastic data available from Rexnord. The analysis is the responsibility of the user since the coupling is only a single component in the system.

Rexnord Thomas Coupling Nomenclature

Use the following nomenclature guide to identify and order Thomas Disc Couplings.

Coupling Size	Type/Series	Modifications	Distance Between Shaft Ends ("C" Length)	Hub Bore
2506	XTSR71	B	9.00	3.250 x 2.50

Type/Series		Modifications		Distance Between Shaft Ends ("C" Length)	Hub Bore
XTSR71	Current Adapter Series	B	= Balanced	9.00"	110 mm x Taper
XTSR52	Current Non-adapter Series	ES	= Engineered Special	N/A	1.00 x 2.00
DBZ	Close Coupled Series	L	= Long Hub	130 mm	Taper x 3.00
AMR	Heavy Duty Fixed Spacer Series	W	= Large Hub w/ adapter		etc.
CMR	Heavy Duty Flywheel Mount Spacer Series	C	= Special Coating (defined on drawings)		
SR54RDG	Close Coupled Series	D	= Special Disc Pack Material (defined on drawings)		
SN	Long Span Spacer Series	R	= Retrofit assembly (XTSR71 with special adapters to bolt up to John Crane or Thomas adapter hubs)		
THP	High Performance				
SR63	High Performance				
SR71	Adapter Series 6-bolt				
SR71-8	Adapter Series 8-bolt				
SR52	Non-adapter Spacer Series				

NOTE: Dimensions subject to change. Certified dimensions of ordered material furnished on request.

866-REXNORD/866-739-6673 (Within the U.S.)
414-643-2366 (Outside the U.S.)
www.rexnord.com

Why Choose Rexnord?

When it comes to providing highly engineered products that improve productivity and efficiency for industrial applications worldwide, Rexnord is the most reliable in the industry. Commitment to customer satisfaction and superior value extend across every business function.

Delivering Lowest Total Cost of Ownership

The highest quality products are designed to help prevent equipment downtime and increase productivity and dependable operation.

Valuable Expertise

An extensive product offering is accompanied by global sales specialists, customer service and maintenance support teams, available anytime.

Solutions to Enhance Ease of Doing Business

Commitment to operational excellence ensures the right products at the right place at the right time.

REXNORD

Rexnord Company Overview

Rexnord is a growth-oriented, multi-platform industrial company with leading market shares and highly trusted brands that serve a diverse array of global end markets.

Process & Motion Control

The Rexnord Process & Motion Control platform designs, manufactures, markets and services specified, highly engineered mechanical components used within complex systems where our customers' reliability requirements and the cost of failure or downtime are extremely high.

Water Management

The Rexnord Water Management platform designs, procures, manufactures and markets products that provide and enhance water quality, safety, flow control and conservation.

2000 02/16

SECTION 4.3

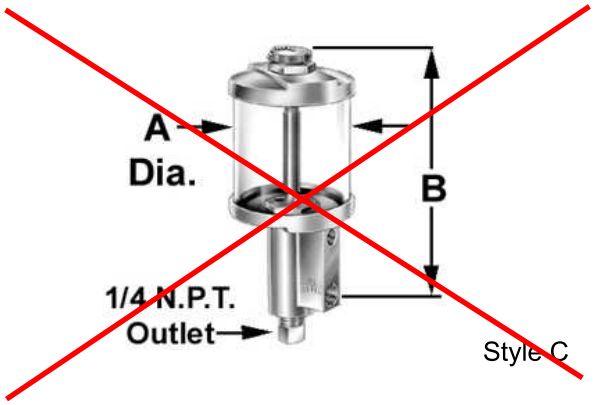
CONSTANT LEVEL OILER

Lone Star Blower
8883 West Monroe
Houston, TX 77061

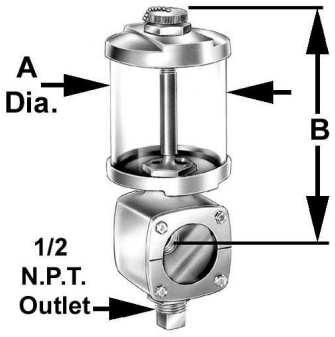
PH: 832-532-3112
FAX: 832-532-3115

Constant Level Lubricators

Are built to give long, trouble free service. They will maintain a fixed liquid level in a bearing housing or gear box. When the liquid in the bearing recedes because of liquid consumption, the liquid seal on the inside of the lubricator is temporarily broken. This allows air from the air intake to enter the lubricator reservoir, releasing the liquid until a seal and proper level are again established. The Style CS Constant Level Oiler is identical in design to Style C with two exceptions. A large sight for viewing the liquid level and condition of the liquid is provided, plus there are larger liquid outlets for rugged, heavy duty installations.



Style C



Style CS

Catalog No. Style C		Catalog No. Style CS		Capacity	A	B Style C	B Style CS
Acrylic	Pyrex	Acrylic	Pyrex				
B-518-1	B-518-11	B-576-1	B-576-11	2-1/2 oz.	2	5-3/16	5-1/4
B-518-2	B-518-12	B-576-2	B-576-12	5 oz.	2-1/2	5-11/16	5-3/4
B-518-3	B-518-13	B-576-3	B-576-13	9 oz.	3	6-1/2	6-9/16
B-518-4	B-518-14	B-576-4	B-576-14	1 pt.	3-1/2	7-1/2	7-9/16
B-518-5	B-518-15	B-576-5	B-576-15	1 qt.	4-1/4	8-3/4	8-13/16
B-518-6	B-518-16	B-576-6	B-576-16	1/2 gal.	5-1/2	10-3/4	10-13/16

When Ordering Specify:
• Catalog Number

Specifications:
• Pressure ..... Atmospheric Pressure
• Temperature ..... 160º F. Maximum Acrylic
225º F. Maximum Glass
• Reservoir ..... Clear Acrylic (Glass Available)
• Seals ..... Buna-N
• Sight ..... Glass
• Covers ..... Aluminum Alloy
• Body ..... Aluminum Alloy

INSTALLATION

1. Oil level is usually marked on the base of oiler. Mount oiler by using side or bottom outlet at the exact and most desirable level.
2. Correct oil level is lowest level at which bearing operates perfectly.
3. Lubricator should be level in all directions to function at its best.
4. Keep connections short, rigid, and close to bearing to avoid vibration.
5. Fill bearing well by filling oiler. Repeated filling may be necessary.
6. The anti-friction bearings should be fitted with breather tubes piped to the outside or to air intake of oiler.
7. ***On oilers with top filler cap, be sure cap is always screwed down tight. Removing filler cap shuts off oil supply. Loose filler cap causes leakage of oil from reservoir through vent hole, rendering oiler ineffective.***

PRINCIPLE

Constant level lubricators automatically maintain the oil in a bearing reservoir at a constant level. Operation is based on the liquid seal principle. When the oil in the bearing recedes because of oil consumption, the liquid seal on the inside of the lubricator is temporarily broken. This allows air from the air intake to enter the lubricator reservoir, releasing oil until a seal and proper level are again established.

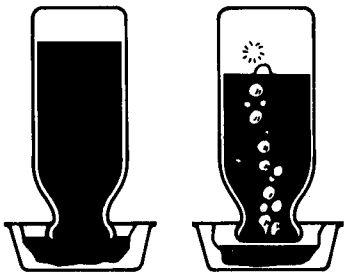


Figure 1

This installation is especially suitable for bearings having excessive back pressure or vacuum. A constant level is maintained in spite of air pressure or vacuum in bearing, as equalizing tube assures static balance of pressure between bearing and oiler.

APPLICATIONS

Constant level lubricators are used on sleeve bearing, anti-friction bearings, gear boxes, pump housing, etc. Other uses include moistening pads and any other application demanding the maintenance of a constant liquid level.

OIL LEVEL

Oil-Rite has available constant level lubricators with fixed or with adjustable oil level. Original equipment manufacturers usually prefer lubricator with fixed oil level to make an installation tamperproof.

OIL RESERVOIR

Oil-Rite offers constant level lubricators with acrylic, glass, or high temperature plastic reservoirs to suit specific applications. The reservoirs are transparent to permit a visual check of the oil supply at all times. Since the oil in the reservoir assumes the same color as that in the bearing housing, a visual check of the condition of the oil is also afforded.

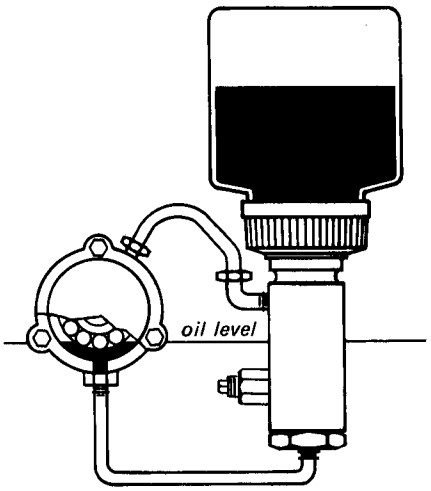


Figure 2

AIR INLET

The air inlet on Oil-Rite's constant level lubricators is provided with a pipe thread to accommodate an air filter for the prevention of dust and dirt getting into the oil.

For dusty and dirty surroundings, such as those found in cement mills, textile plants, paper mills, coal handling facilities, etc. it is recommended that the air inlet of the lubricator be piped into the top of the bearing housing. Such a closed circuit offers full protection.

Pressure differential between the air intake of the lubricator and the bearing housing, such as is experienced on ventilating fans and blowers, anti-friction bearings,etc., necessitates that the air inlet on the lubricator be piped into the top of the bearing housing to equalize pressure.

SURGE LEVEL

In certain cases, such as in gear boxes, a considerable quantity of oil is carried by the gears to the upper portion of the gear housing during operation. After shutdown, the oil surges back to the lubricator and raises the oil level. Constant level lubricator should therefore be equipped with a sufficient surge level to prevent oil from overflowing through the air intake.

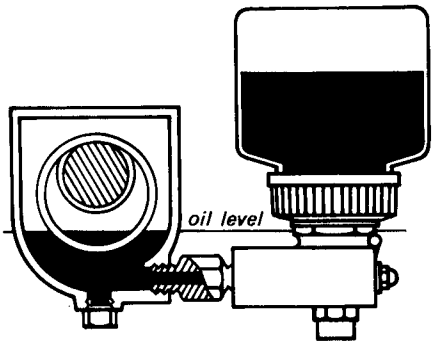


Figure 3

Typical installation for ring-oiled bearings. Oil level should be slightly above inside diameter of ring. With the correct oil level the ring carries oil to shaft smoothly without splashing and chattering.

Oil-Rite® CORPORATION
P. O. BOX 1207, MANITOWOC, WI 54221-1207 (920) 682-6173 FAX (920) 682-7699
Internet http://www.oilrite.com e-mail sales@oilrite.com

SECTION 4.4

REDUCED VOLTAGE SOLID STATE STARTER

Lone Star Blower
8883 West Monroe
Houston, TX 77061

PH: 832-532-3112
FAX: 832-532-3115

Bulletins 150, 152 and 153
Enclosed Smart Motor Controllers

Allen-Bradley

SMC™-3, SMC™ Flex and SMC™-50 soft starters

Advantages

- Reduced mechanical system stress, wear and maintenance
- Lower voltage/current spikes and line disturbances
- Decreased water hammer in pumping applications
- Snap-together wiring technology for faster, easier installation
- Lower peak electrical use and demand charges
- Floor standing indoor/outdoor rated enclosure has compact footprint requiring less space

Functionality

Enhanced Control Options

- User programmability
- Scalable to critical nature of application
- Local, manual and automatic modes

Inherent Diagnostics

- Current, voltage, power and energy monitoring
- Faults and alarms

Lowest Installed Cost with Network Integration

- Ease of communication linkage (e.g. multi protocol, AOPs)
- Localized I/O and control
- Wire reductions

Enclosed soft starters offer a balance of performance, versatility and price.

Overview

The capabilities and flexibility of the enclosed SMC-3, SMC Flex and SMC-50 soft starters make them ideal for almost any application. They minimize mechanical wear that results from full-voltage starting, enabling longer starting. This prolongs system life and lowers line disturbances, reducing downtime and increasing efficiency. Factory-built, enclosed soft starters are customized solutions tailored to your specific application, but pre-engineered for standardization and quick delivery available through regional configuration centers.

Offering

Enclosed SMC-3, SMC Flex and SMC-50 soft starters are available as non-combination, combination fusible disconnect or combination circuit breaker. Solutions can be fully customized with any selection of a wide variety of factory-installed options, and are pre-engineered for quick factory lead times.

With industry-leading customization, available options, and functionality, these soft starters are a clear-cut choice for diverse and specialized applications.

Enclosed Soft Starting Solutions

Enclosed soft starting solutions encompass all the starting, stopping, protection and diagnostics benefits of Allen-Bradley® soft starters, in a customizable, pre-engineered solution. Factory-built enclosed soft starters are shipped ready to install, with quick lead times.

Enclosed SMC-3 soft starter

Compact, cost-effective solution for on-machine or pumping applications

- Available 3…480 A
- Snap-together wiring technology[1]

Bulletins 150C, 152C, 153C

APPLICATIONS: *Conveyors • Fans • Pumps • Chillers • Mixers • Lifts*

Enclosed SMC Flex soft starter

Modular design with advanced performance and communications flexibility

- Available 5…1250 A
- Snap-together wiring technology[1]
- Optional full-numeric keypad, door-mounted HIM

Bulletins 150F, 152F, 153F

APPLICATIONS: *Compressors • Pumps • Fans • Conveyors • Bandsaws • Chillers • Centrifuges*

Enclosed SMC-50 soft starter

Scalable solution, satisfying a wide variety of control needs

- Available 90…520 A
- Snap-together wiring technology[1]
- Normal and heavy-duty ratings
- Optional start- or run-duty external bypass or integrated bypass
- Optional door-mounted HIM with easy-selection arrows and soft keys for navigation
- Optional digital and analog I/O expansion modules and protection

Bulletins 150S, 152S, 153S

APPLICATIONS: *Pumps • Compressors • Fans • Conveyors • Bandsaws • Mills • Crushers • Grinders • Shredders • Centrifuges*

[1]Snap-together wiring available from 90... 520 A

Soft Starter Feature Comparison

	SMC-3 soft starter	SMC Flex soft starter	SMC-50 soft starter
True 3-Phase control	Yes	Yes	Yes
Bypass	Internal	Internal	External or Internal
Protection and Diagnostics	Basic	Advanced	Industry leading
Start/stop modes	5	9	17
Enclosure type	1/12/4 or 3R	1/12/4 or 3R	1/12/4 or 3R
Factory-installed communication modules (optional)	None	RS-485, DeviceNet™, Ethernet/IP, ControlNet™, ProfiBUS	RS-485, DeviceNet™, Ethernet/IP, ControlNet™, ProfiBUS
Voltage range	200....575V AC	200....575V AC	200....575V AC
Control voltage	100....240V AC	100....240V AC	100....240V AC
Option offering and customization	Moderate	Extensive	Extensive
Customization through modified industrial controls	Yes	Yes	Yes

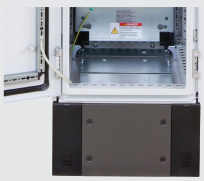
Soft Starter Enclosures

Standard enclosure sizes are available in three widths

- 400 mm (15.7 in.)
- 600 mm (23.6 in.)
- 1000 mm (39.4 in.)

Enclosure accessories are available for each width

- Mounting rail for door installation
- Enclosure mounting foot, high strength plastic
- Enclosure mounting foot, sheet steel



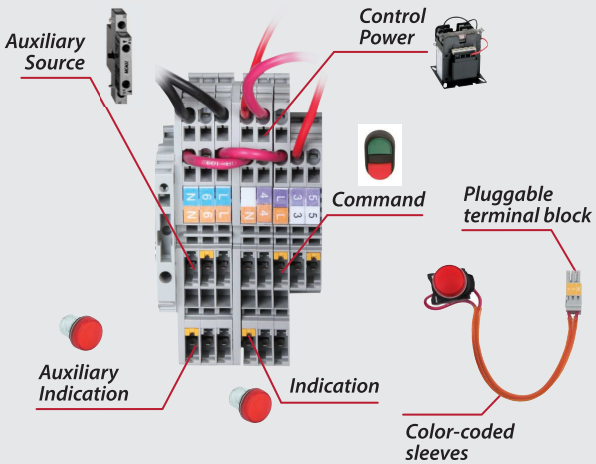
Ratings and Environmental Specifications

- Standards compliance: UL 508A
- Enclosure and ambient operating temperature: -5…40 °C (23…104 °F)
- Altitude: 2000 m (6560 ft)
- Humidity: 5…95% (non condensing)

Snap-together Wiring Technology

Wiring Made Easy

Many of our enclosed soft starters[1] now feature component wiring that is color-coded by function. The wiring sleeve cover corresponds to a colored label on the terminal block, reducing wiring errors and allowing quicker installation times.



[1]Snap-together wiring available from 90...520 A

Modified Industrial Controls

The Modified Industrial Controls business at Rockwell Automation can take your panel design needs from conception to completion. We provide a unique engineer-to-engineer relationship that helps to ensure that every aspect of your panel is designed, developed and delivered according to your specifications, schedule and budget.

Customizable panels include:

- Programmable controllers
- Starters
- Distributed I/O
- Servo drives
- Push buttons and pilot lights
- Partner products and other third-party devices

Find out more about
Modified Industrial Controls:

www.rockwellautomation.com/go/lit/icp-modified

Regional Configuration Centers

The Rockwell Automation regional configuration centers are located in your area to help you get the right product, right when you need it.

Availability

- Products ship within 5 days

Flexibility

- Factory-installed modifications
- Comply with regional needs and standards

Enclosed soft starters are assembled in the Central and Western regional configuration centers.

www.rockwellautomation.com

Power, Control and Information Solutions Headquarters

Americas: Rockwell Automation, 1201 South Second Street, Milwaukee, WI 53204-2496 USA, Tel: (1) 414.382.2000, Fax: (1) 414.382.4444
Europe/Middle East/Africa: Rockwell Automation NV, Pegasus Park, De Kleetlaan 12a, 1831 Diegem, Belgium, Tel: (32) 2 663 0600, Fax: (32) 2 663 0640
Asia Pacific: Rockwell Automation, Level 14, Core F, Cyberport 3, 100 Cyberport Road, Hong Kong, Tel: (852) 2887 4788, Fax: (852) 2508 1846

Publication 150-PP007C-EN-P – September 2018
Supersedes 150-PP007B-EN-P - February 2017

Notes:

600 HP SMC-Flex Solid-State Controller with Circuit Breaker, 780A Controller, NEMA Type 1,12 Enclosure ,400...480V AC 3 Phase 50/60Hz, 120V AC Control, 1200A Circuit Breaker
-Control circuit transformer with fusing
-HIM mounted on the door
-No other pilot devices
-10 spare terminal blocks – unwired

Approx. Enclosure size: 2000H x 1600W x 500D mm (78.7H x 63.0W x 19.7D in) 1
2 pole control relay as Fault status indicator NO / NC 1

SECTION 4.5

INLET FILTER SILENCER

Lone Star Blower
8883 West Monroe
Houston, TX 77061

PH: 832-532-3112
FAX: 832-532-3115

Tri-Vent® Series P09

Intake Filter Silencers

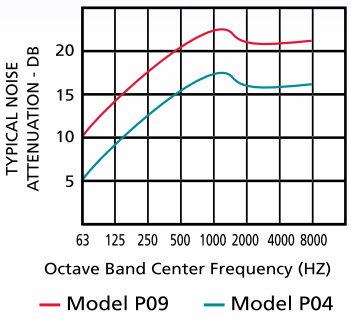
No Compromise

For a generation, everyone assumed that high-efficiency filters increased maintenance costs, and the only way to make a filter element last longer was to allow more dirt to pass through. This is known as "the filtration compromise."

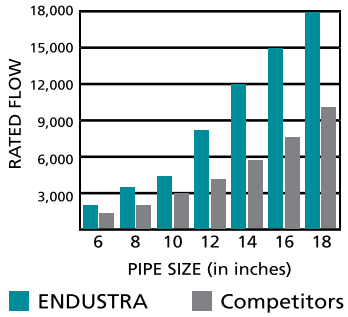
Tri-Vent® technology makes no compromise. Our high-efficiency filters reduce energy consumption, and our exclusive Enduralast® Synthetic Media provide optimal filter element life in the harshest environments.

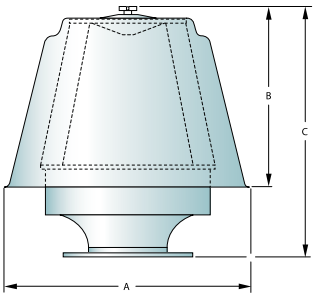
Reduce cost, reduce weight, and reduce maintenance. Don't compromise.

TYPICAL NOISE ATTENUATION



RATED FLOW COMPARISON





Model #	Enduralast® Element Number		FLG Size	Nominal Dimensions			Rated Flow SCFM	Weight
	Ultra Synthetic, 99.97% eff. @ 1-µ (nom)	Hi-Flow Synthetic, 98% eff. @ 10-µ (nom)		A	B	C		
P09RG-	LSB1513	LSB1523	3"	16	8	18	600	30
P09RH-	LSB1513	LSB1523	4"	16	8	18	900	30
P09RR-	LSB1513	LSB1523	5"	16	8	18	1100	30
P09RI-	LSB1513	LSB1523	6"	16	8	18	1350	30
P09RI-	LSB1514	LSB1524	6"	26	11	21	2000	50
P09RI-	LSB1515	LSB1525	6"	27	15	25	2250	60
P09RJ-	LSB1514	LSB1524	8"	26	11	21	2500	60
P09RJ-	LSB1515	LSB1525	8"	27	15	25	2900	70
P09RJ-	LSB1516	LSB1526	8"	28	20	29	3300	75
P09RK-	LSB1514	LSB1524	10"	26	11	21	3750	70
P09RK-	LSB1515	LSB1526	10"	27	15	25	4000	75
P09RK-	LSB1516	LSB1526	10"	28	20	29	4250	80
P09RL-	LSB1515	LSB1525	12"	27	15	25	5150	85
P09RL-	LSB1516	LSB1526	12"	28	20	29	6500	85
P09RL-	LSB1517	LSB1527	12"	38	26	35	8250	90
P09RM-	LSB1517	LSB1527	14"	38	26	35	12,000	105
P09RN-	LSB1517	LSB1527	16"	38	26	35	15,000	115
P09RS-	LSB1517	LSB1527	18"	38	26	35	18,000	125

Options

- 3-6" NPT connections
- Wire Mesh Medium, 60% eff. @ ISO Fine Dust
- Stainless steel or aluminum
- Custom fittings
- Special coatings
- FDA/USDA standards
- HEPA/ULPA
- Over 75 media types

ENDUSTRA
Endustra Filter Manufacturers • 1145 Birch Drive, Schererville, Indiana 46375
800-521-1008 • 219-322-1550 • FAX: 219-322-5870 • www.endustrafilters.com

SECTION 4.6

INLET ISOLATION VALVE

Lone Star Blower
8883 West Monroe
Houston, TX 77061

PH: 832-532-3112
FAX: 832-532-3115

RESILIENT SEATED

BUTTERFLY VALVES

Bray®

BRAY.COM

THE HIGH PERFORMANCE COMPANY

ISOLATION FROM LINE MEDIA

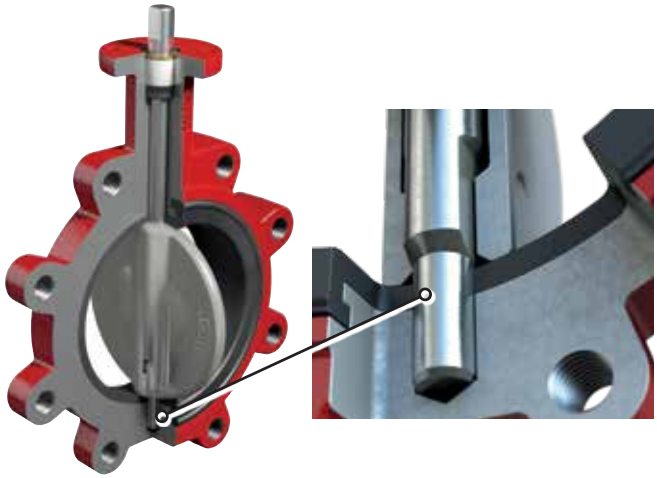
Bray's seat design and internal disc to stem connection isolates the line media from the body and stem.

INTERNAL DISC TO STEM CONNECTION

Series 30/31 Sizes 2"– 20" (50mm–500mm)

Bray offers Double "D" precision machined flats on the stem and in the disc. The Series 30/31 internal, non-wetted connections eliminate exposed external disc to stem connections.

The disc and the stem connection minimizes hysteresis and produces maximum strength engagements. All stem designs incorporate a blowout proof feature.



SEAT DESIGN

The seat is designed to seal with slip-on or weld-neck flanges and the molded o-ring eliminates the need for flange gaskets. The tongue and groove locks the seat in place and makes the valve dead end capable.

Tongue and Groove

POLYESTER COATING

The Bray standard polyester body coating is a hard, gloss red finish. The polyester coating provides excellent corrosion and wear resistance.

Chemical Resistant

Resistant to dilute acids and alkalies, petroleum solvents, alcohols, greases and oils.

Weatherability

Resistant to humidity, water and ultraviolet radiation.

Abrasion and Impact Resistant

NYLON 11 COATING

Nylon 11 has superior corrosion resistance and has been used successfully in many applications such as water, cement, food and seawater.

Weatherability

Bray's Nylon 11 coating has been salt spray tested in excess of 2000 hours and used in seawater immersion service for over 30 years without any deterioration of the coating resulting in no corrosion to the coated metal components.

Abrasion and Impact Resistant

SEACORR® COATING

This proprietary coating for actuators provides superior product protection in corrosive conditions, tested to ASTM B-117.

Other customer specified coating materials are available. Please consult your local Bray representative for your specific application.

All Bray valves are pressure tested to 110% of rated pressure to assure bubble tight shutoff.

The Bray Series 30/31 features a high strength one piece stem design utilizing an efficient internal disc to stem connection. This resilient seated butterfly valve provides a primary and secondary seal between the disc and seat as well as the stem and seat which ensures the total encapsulation of the line media and zero external leakage.

PRESSURE RATINGS

BIDIRECTIONAL BUBBLE TIGHT SHUT OFF – Standard Disc* Downstream flanges and disc in closed position		
Series 30/31 Standard Disc*	2"-12" (50-300mm)	175 psi (12 bar)
	14"-20" (350-500mm)	150 psi (10.3 bar)
DEAD END SERVICE – Lug Bodies and Standard Disc* No downstream flanges and disc in closed position		
Series 31	2"-12" (50-300mm)	75 psi (5.2 bar)
	14"-20" (350-500mm)	50 psi (3.4 bar)
BODY: 250 psi (17.2 bar) CWP		

*For low pressure (50 psi) applications, Bray offers a standard reduced disc diameter to decrease seating torques and extend seat life, thus increasing the valve's performance and reducing actuator costs.

VELOCITY LIMITS FOR ON/OFF SERVICES

FLUIDS: 30 ft/sec (9 m/s)	**GASES:** 175 ft/sec (54 m/s)

1 – **STEM RETAINING ASSEMBLY:** The stem is retained in the body by means of a unique stainless steel Spirolox® retaining ring, a thrust washer and two C-rings, manufactured from brass as standard, stainless steel upon request.

2 – **STEM BUSHING:** Non-corrosive, heavy duty acetal bushing absorbs actuator side thrust.

3 – **STEM SEAL:** Double "U" cup seal design is self-adjusting and gives positive sealing in both directions.

4 – **PRIMARY AND SECONDARY SEALS:** These seals prevent line media from coming in contact with the stem or body. The primary seal is an interference fit of the molded seat flat with the disc hub. The secondary seal is created because the stem diameter is greater than the diameter of the seat stem hole.

5 – **BODY:** One piece wafer or lug style. Polyester coating for excellent corrosion resistance. Nylon 11 coating is available as an option.

6 – **SEAT:** Bray's tongue and groove seat design provides complete isolation of flowing media from the body. The seat also features a molded o-ring which eliminates the use of flange gaskets.

7 – **DISC:** Casting is spherically machined and hand polished to provide a bubble tight shutoff, minimum torque, and longer seat life. Bray's resilient Nylon 11 coating comes as standard.

8 – **STEM:** Precision double "D" disc to stem connection drives the disc without the need for screws or pins. The close tolerance, double "D" connection that drives the valve disc is an exclusive feature of the Bray valve. Disassembly of the Bray stem is just a matter of pulling the stem out of the disc.

MATERIAL SELECTION OPTIONS

BODY	DISC	STEM	SEAT
Cast Iron✦	Nylon 11 Coated Ductile Iron✦	416 Stainless Steel✦	BUNA-N Food Grade✦
Ductile Iron✦	316 Stainless Steel✦	304 Stainless Steel	EPDM Food Grade✦
Carbon Steel	Nickel Aluminum Bronze	316 Stainless Steel	FKM*
Aluminum	Coated Ductile Iron	Monel® K500	White BUNA-N Food Grade
	Halar® Coated Ductile Iron		Bonded EPDM
	304 Stainless Steel		Bonded BUNA-N
	Duplex Stainless Steel		Viton
	Super Duplex Stainless Steel		
	Hastelloy®		

✦Standard Option

*FKM is the ASTM D1418 designation for fluorinated hydrocarbon elastomers (also called fluoroelastomers).

Monel® is a registered trademark of The International Nickel Company, Inc.

Halar® is a registered trademark of Solvay Solexis, Inc.

Hastelloy® is a registered trademark of Haynes International, Inc.

SERIES 31H

2"-20" (50mm-500mm)

Series 31H Lug valves are drilled and tapped to meet ASME Class 125/150 and PN16 flanges. Series 31H valves are designed for manual operation only.

PRESSURE RATINGS

BIDIRECTIONAL BUBBLE TIGHT SHUT OFF AND DEAD END SERVICE	
2"-20" (50-500mm)	250 psi (17.2 bar)
BODY: 250 psi (17.2 bar) CWP	

VELOCITY LIMITS FOR ON/OFF SERVICES

FLUIDS: 30 ft/sec (9 m/s)	**GASES:** 175 ft/sec (54 m/s)

STANDARD MATERIAL SELECTIONS

Body	Cast Iron Ductile Iron
Disc	Nickel Aluminum Bronze Nylon 11 Coated Ductile Iron 316 Stainless Steel
Stem	416 Stainless Steel
Seat	Bonded EPDM Bonded BUNA-N

Material availability depends on valve size and series. Other materials are available. Please consult your local Bray representative for your specific application.

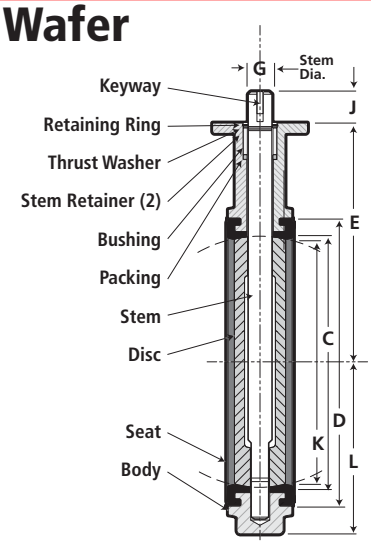
BARE STEM FOR USE WITH ACTUATOR

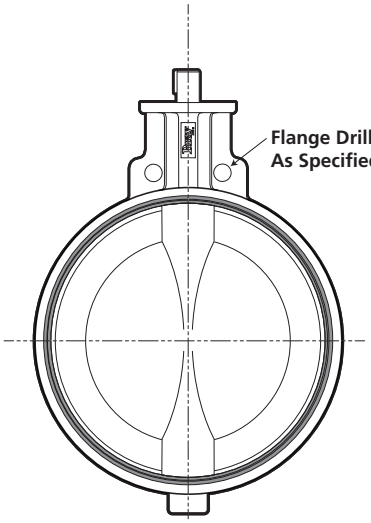
Bray

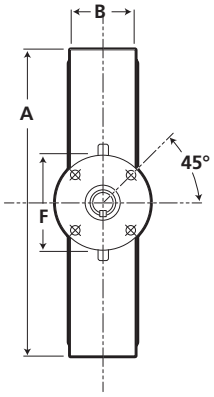
Standard Series 30-31 Butterfly Valves

Sizes 14" - 20" (350mm - 500mm) • Dimensions

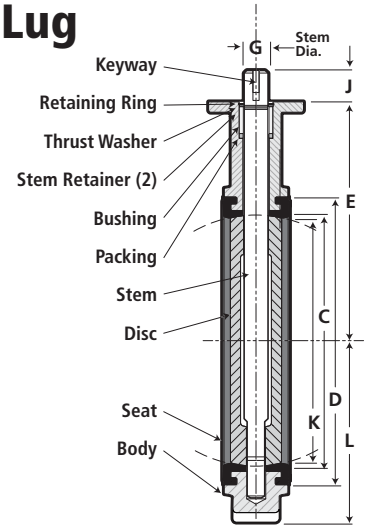
Series 30 Wafer

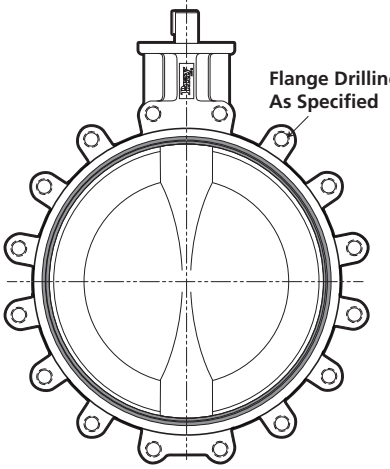


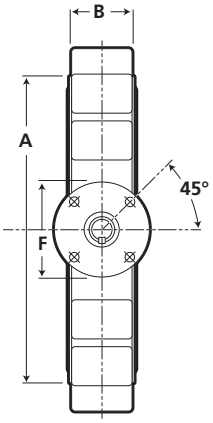




Series 31 Lug







IMPERIAL DIMENSIONS: Inches																				Lug Bolting Data		
Valve Size	A	B	C	D	E	F	Top Plate Drilling			G	J	Key Size	K	L		Adapter Code	Weight (lbs.)		Bolt Circle	No of Holes	Threads ISO Coarse
							BC	No of Holes	Hole Diameter					Wafer	Lug		Wafer	Lug			
14	17.05	3.00	13.25	15.28	13.62	5.91	4.92	4	.57	1.38	2.00	.39x.39	13.04	9.38	9.93	F	95	114	18.75	12	1-8
16	19.21	4.00	15.25	17.14	14.75	5.91	4.92	4	.57	1.38	2.00	.39x.39	14.85	10.75	~~11.30~~	F	135	~~166~~	21.25	16	1-8
18	21.12	4.25	17.25	19.47	16.00	8.27	6.50	4	.81	1.97	2.50	.47x.39	16.85	12.00	12.15	G	200	226	22.75	16	1⅛-7
20	23.25	5.00	19.25	21.59	17.25	8.27	6.50	4	.81	1.97	2.50	.47x.39	18.73	14.00	14.00	G	260	305	25.00	20	1⅛-7

Note: K dimension is disc chordal dimension at valve face.

METRIC DIMENSIONS: Millimeters																				Lug Bolting Data		
Valve Size	A	B	C	D	E	F	Top Plate Drilling			G	J	Key Size	K	L		Adapter Code	Weight (Kg)		Bolt Circle	No of Holes	Threads ISO Coarse
							BC	No of Holes	Hole Diameter					Wafer	Lug		Wafer	Lug			
350	433	76.2	337	388	346	150	125	4	14	35	51	10x10	331	238	252	F	43	52	476	12	1-8
400	488	101.6	387	442	375	150	125	4	14	35	51	10x10	377	273	287	F	61	75	540	16	1-8
450	536	108.0	438	495	406	210	165	4	21	50	64	12x10	428	305	309	G	91	103	578	16	1⅛-7
500	591	127.0	489	548	438	210	165	4	21	50	64	12x10	476	348	358	G	118	138	635	20	1⅛-7

Note: K dimension is disc chordal dimension at valve face.

Drawings are for reference only. Please refer to Bray ES drawings on the Bray website, www.bray.com. Bray reserves the right to change product dimensions without notice.

SR Drawing #30/31-14/20-in

Inquire/P.O. No.:_____

Customer/Project: _____

Bray Order No.: _____

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THE HIGH PERFORMANCE COMPANY

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Bray International, Inc.
13333 Westland East Blvd.
Houston, Texas 77041
Tel: 281.894.5454
bray.com

B-1050_EL_Resilient Seated Valves_4_2019

SECTION 4.7

INLET VALVE ACTUATOR

Lone Star Blower
8883 West Monroe
Houston, TX 77061

PH: 832-532-3112
FAX: 832-532-3115

rotork®

Keeping the World Flowing
for Future Generations

IQ Range

Multi-turn and Part-turn Intelligent Electric Valve Actuators

Reliability in critical flow control applications

Reliable operation when it matters

Assured reliability for critical applications and environments.

Whether used infrequently or continuously, Rotork products will operate reliably and efficiently.

Quality-driven global manufacturing

We offer products that have been designed with over 60 years of industry and application knowledge.

Our research and development ensures cutting edge products are available for multiple applications across multiple industries.

Customer focused service and worldwide support

Rotork solve customer challenges and develop new solutions that are tailored to the needs of our clients.

We offer dedicated, expert service and support from initial inquiry, to product installation, to long term after sales care.

Low cost of ownership

Long-term reliability prolongs service life.

Rotork helps to reduce long term cost of ownership and provides greater efficiency to process and plant.

IQ Range

Comprehensive product range serving multiple industries

Rotork products offer improved efficiency, assured safety and environmental protection across sectors such as the Power, Oil & Gas, Water & Wastewater, HVAC, Marine, Mining, Pulp & Paper, Food & Beverage, Pharmaceutical and Chemical sectors.

Market leaders and technical innovators

We have been the recognised market leader in flow control for over 60 years.

Our customers rely upon Rotork for innovative solutions to safely manage the flow of liquids, gases and powders.

Global presence, local service

We are a global company with local support.

Manufacturing sites, service centres and sales offices throughout the world provide unrivalled customer services, fast delivery and ongoing, accessible support.

Corporate social responsibility is at the heart of our business

We are socially, ethically and environmentally responsible and committed to embedding CSR across all our processes and ways of working.

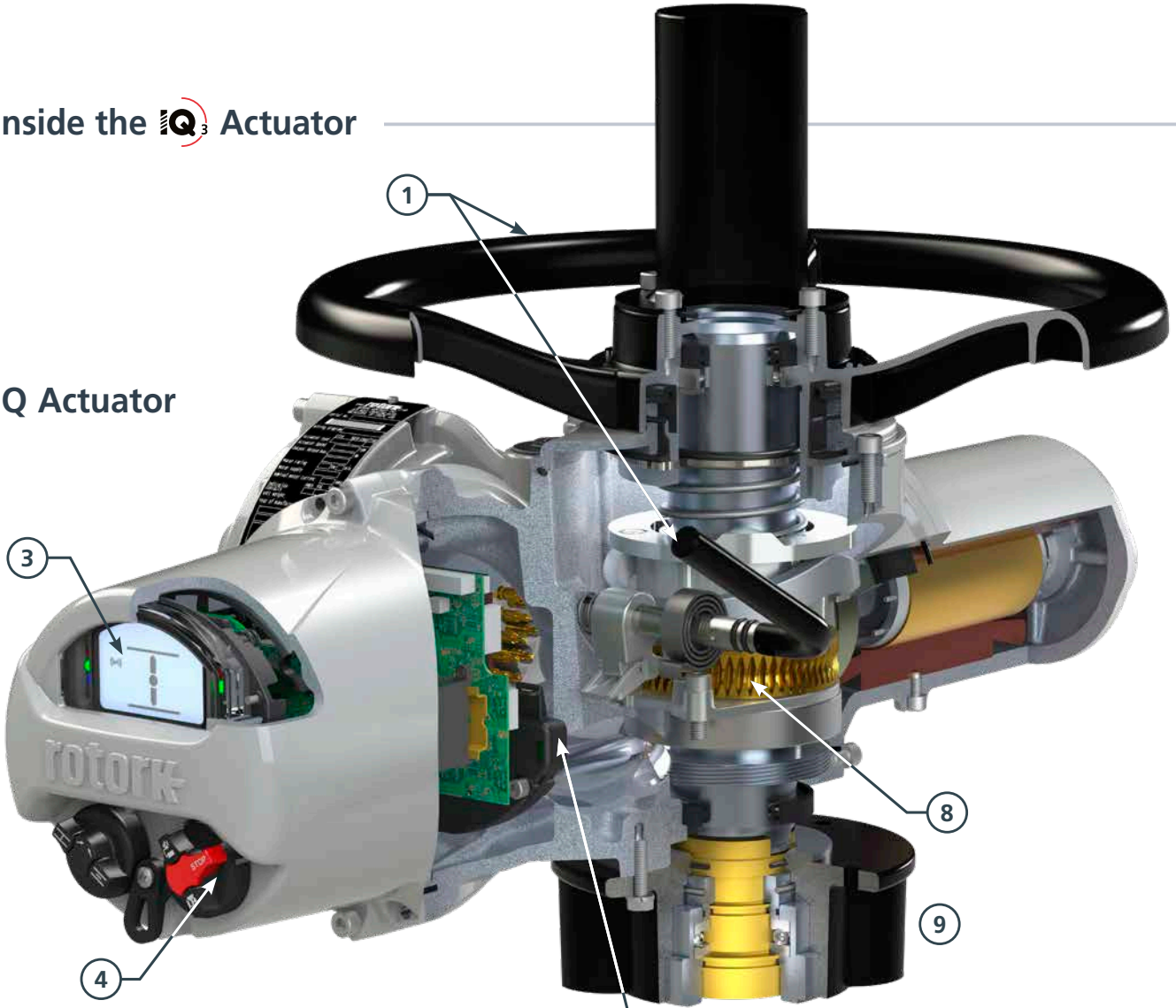
The most **robust actuator design** in the industry providing **exceptional reliability**

- Continuous position tracking at all times, even without power
- On power loss, graphical interface, remote indication and data logger are maintained and accessible
- Oil bath lubrication provides extended life and the ability to mount in any orientation
- Water ingress protection, not reliant on terminal cover or cable gland sealing – double-sealed to IP66/68 20 m for 10 days
- Increased protection by using independent torque and position sensing
- Remote operation, configuration and commissioning up to 100 m from actuator, with Remote Hand Station
- Safe, motor-independent, handwheel operation available at all times
- Detailed trend analysis and diagnostic data available for asset management
- Field upgradeable and configurable control & indication options, using the *Bluetooth*® enabled setting tool
- Real time valve and actuator performance information viewable on screen
- Rapid and secure commissioning & configuration even without power, via non-intrusive and intrinsically safe Rotork Bluetooth® Setting Tool *Pro*
- Certified for safety applications (SIL2/3)
- Easy installation and maintenance using detachable thrust bases
- Explosionproof to international standards
- Backed by Rotork global support

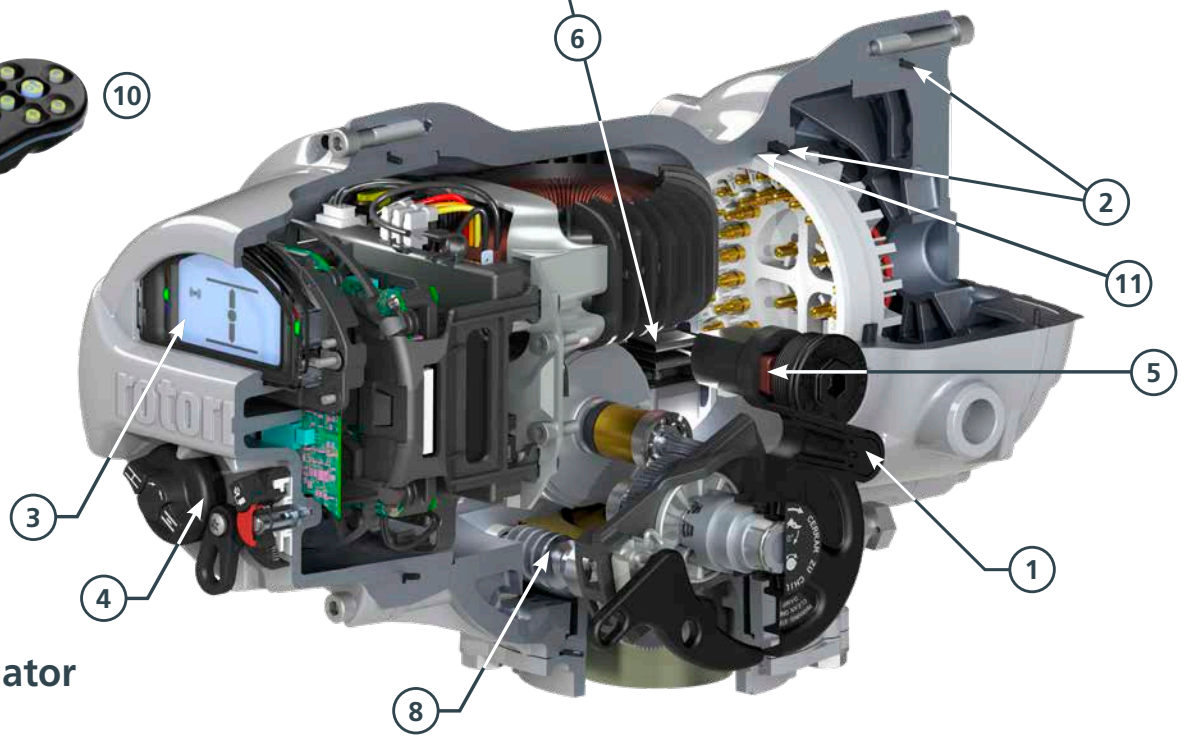
IQ3

Inside the IQ3 Actuator

IQ Actuator



IQT Actuator



1. Hand Operation

Direct-drive and geared handwheels sized for effective manual operation of the valve. Handwheel drive is independent of the motor drive and is selected with a lockable lever for safe operation even when the motor is running. See section 9.1.

2. Environmental Sealing IP66/68; 20 m for 10 days

The double-sealed terminal compartment results in the actuator enclosure being completely sealed, protecting the actuator from environmental ingress. See section 5.

3. Display

The advanced display has a wide viewing angle making it legible from a distance. The dual mode display allows a high temperature range of operation for position (-50 to +70°C) in addition to detailed graphical information. See section 7.2.

4. Local Controls

Open/Close and Local/Stop/Remote selectors are magnetically coupled to the solid state switches inside the cover. This along with double-sealing, further enhances the non-intrusive protection of the actuator. See section 7.2.

5. Battery

A battery is provided to support the display, remote indication and configuration when no mains power is available. See section 9.12.

6. Position Control

Patented absolute position encoder is provided to enable robust, high accuracy measurement of up to 8,000 actuator output rotations under all conditions, including loss of mains power. See section 9.7.

7. Torque Sensor

State-of-the-art piezo torque sensor for IQ provides reliable torque measurement over a wide temperature range. See section 9.6.

8. Drive Train

Simple, proven, robust and lubricated for life in a self-contained oil bath, with the ability to perform in any orientation. See section 9.2.

9. Separable Bases

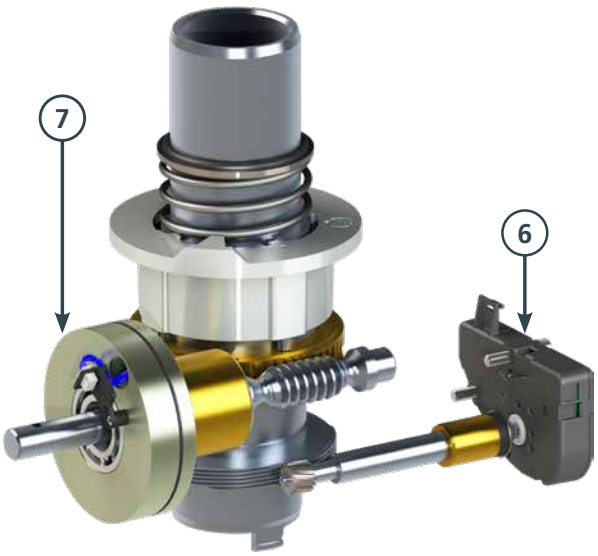
For all actuator frame sizes, the thrust and non-thrust base types are separate to the main gearcase facilitating easy installation. See section 2.

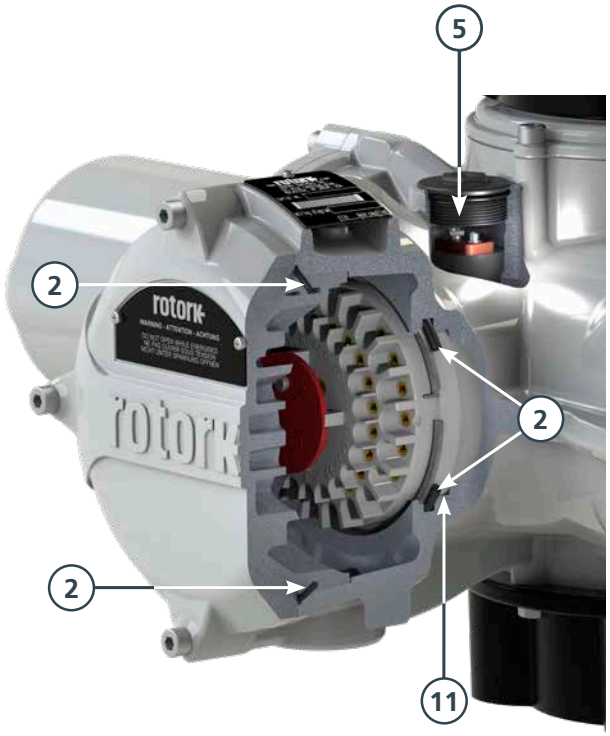
10. Rotork Bluetooth® Setting Tool *Pro*

Intrinsically-safe setting tool used for commissioning and data logger download. See section 7.2.

11. Certified for use in Hazardous Areas

The Rotork explosionproof Exde enclosure has a flamepath between the main enclosure and the terminal enclosure. This means an explosion on either side of the terminal compartment will not be transmitted to the other side or the outside environment. See section 5.





Actuator Selection for Linear Valve Types

Actuator selection for linear valve types: Wedge, Conduit/slab, Parallel slide, Globe, Choke, Knife, Sluice/weir, Diaphragm.

Torque/thrust range - actuator availability

Direct

		IQ (3-Phase) Min	**IQ** (3-Phase) Max	**IQS** (1-Phase) Min	**IQS** (1-Phase) Max	**IQD** (DC) Min	**IQD** (DC) Max	**IQM** (3-Phase) Min	**IQM** (3-Phase) Max
Torque	Nm	14	3,000	10	450	11	305	11	544
	lbf.ft	10	2,200	7	332	8	225	8	400
Thrust	kN	44	445	44	150	44	100	44	150
	lbf	10,000	100,000	10,000	33,750	10,000	22,480	10,000	33,750
Class/Starts-Hour		A & B / 60		A & B / 60		A & B / 60		C / 1,200	

With IB Gearbox

		IQ (3-Phase) Min	**IQ** (3-Phase) Max	**IQS** (1-Phase) Min	**IQS** (1-Phase) Max	**IQD** (DC) Min	**IQD** (DC) Max	**IQM** (3-Phase) Min	**IQM** (3-Phase) Max
Torque	Nm	12	7,604	9	3,060	10	2,074	10	3,686
	lbf.ft	9	5,610	7	2,258	7	1,530	7	2,720
Thrust	kN	53	1,320	53	1,320	53	1,320	53	1,320
	lbf	12,000	296,750	12,000	296,750	12,000	296,750	12,000	296,750
Class/Starts-Hour		A & B / 60		A & B / 60		A & B / 60		C / 1,200	

With IS Gearbox

		IQ (3-Phase) Min	**IQ** (3-Phase) Max	**IQS** (1-Phase) Min	**IQS** (1-Phase) Max	**IQD** (DC) Min	**IQD** (DC) Max	**IQM** (3-Phase) Min	**IQM** (3-Phase) Max
Torque	Nm	15	40,718	11	9,756	12	6,612	12	11,750
	lbf.ft	11	30,030	8	7,200	9	4,878	9	8,672
Thrust	kN	53	2,900	53	2,900	53	2,900	53	2,900
	lbf	12,000	651,946	12,000	651,946	12,000	651,946	12,000	651,946
Class/Starts-Hour		A & B / 60		A & B / 60		A & B / 60		C / 1,200	

Direct - Control Valve

		IQTF (A coupling*) Min	**IQTF** (A coupling*) Max	**IQTF** (L coupling*) Min	**IQTF** (L coupling*) Max	**IQL** (3-Phase*) Min	**IQL** (3-Phase*) Max	**IQML** (3-Phase) Min	**IQML** (3-Phase) Max
Torque	Nm	20	250	N/A		N/A		N/A	
	lbf.ft	15	185						
Thrust	kN	44	100	3	76	6	100	5	57
	lbf	10,000	22,480	710	17,086	1,349	22,480	1,124	12,814
Class/Starts-Hour		C / 1,800		C / 1,800		A & B / 60		C / 1,200	

Actuator Selection for Part-turn Valve Types

Actuator selection for part-turn valve types: Butterfly, Ball, Plug, Damper.

Torque range - actuator availability

Direct

		IQT (3-Phase, 1-Phase)		**IQT** (DC)		**IQTM** (3-Phase, 1-Phase)		**IQTM** (DC)	
		Min	Max	Min	Max	Min	Max	Min	Max
Torque	Nm	50	3,000	50	2,000	50	3,000	50	2,000
	lbf.ft	37	2,214	37	1,476	37	2,214	37	1,476
Class/Starts-Hour		A & B / 60		A & B / 60		C / 1800		C / 1800	

With IW/MOW Gearbox

		IQ (3-Phase)		**IQS** (1-Phase)		**IQD** (DC)		**IQM** (3-Phase)	
		Min	Max	Min	Max	Min	Max	Min	Max
Torque	Nm	204	826,888	150	208,000	162	131,950	162	76,964
	lbf.ft	150	609,880	111	153,400	119	97,500	119	56,800
Class/Starts-Hour		A & B / 60		A & B / 60		A & B / 60		C / 1,200	

Direct - Control Valve

		IQTF (B coupling)	
		Min	Max
Torque	Nm	20	3,000
	lbf.ft	15	2,214
Class/Starts-Hour		C / 1,800	

IQT Fail-to-position Options

IQT, IQTM and IQTF actuators are compatible with two fail-to-position solutions. The Shutdown Battery option is suitable for use in hazardous and safe areas. The Battery Backup option is suitable for use in safe areas only. Both fail-to-position solutions will perform a preconfigured action on loss of mains power to the actuator or allow continued operation of the actuator from remote or local commands until battery charge is depleted.

Notes:

- Actual selection may be determined by power supply requirement - (refer to section 7.1), valve stem dimensions and operating time.
- Class/Starts refers to EN15714-2 duty types: A & B: isolating/regulating, C: modulating, D: continuous modulating.

* IQSL 1-phase and IQDL DC variants available - apply to Rotork for details. IQTF-A is limited to 22 output turns. IQTF-L, IQL and IQML are limited to 150 mm (6") stroke.

Design Features

Simple, Secure Commissioning and Configuration

Ensuring correct configuration and keeping it secure is the bedrock of reliable operation.

All IQ range actuators are set up non-intrusively using a Rotork setting tool. Torque levels, position limits, control and indication functions can all be accessed using a Rotork setting tool. Bluetooth wireless connectivity allows easier use without direct line-of-sight and over greater distances, however security has to match. This is achieved by the initial 'pairing' of tool and actuator being carried out by a single infra-red transaction after which a Bluetooth wireless connection automatically takes over. As before, configuration changes are password protected and the actuator is immune to connection by non-Rotork devices or programs.

IQ range actuators benefit from a configurable, information-rich display, with a highly intuitive menu system for commissioning, updates and diagnostics.

IQ range actuators can be interrogated and set up even when mains power is not available; the actuator can be configured and interrogated by using power from its display back-up battery.

- Rapid and secure commissioning and configuration even without power via advanced, multilingual HMI display
- Non-intrusive setting in any environmental conditions - no cover removal required, using the intrinsically safe Rotork Bluetooth® Setting Tool *Pro*
- Easy installation and valve maintenance using detachable thrust bases
- Duplicate operation, configuration and commissioning up to 100 m from actuator with Remote Hand Station (RHS)
- Auto set-up function on part-turn variants

Technological Advances

Position

Reliable valve position sensing is critical. Using the latest technology and after years of testing, the patented Rotork IQ absolute encoder is contactless, has only four active parts, can measure up to 8,000 output turns and has redundancy and self checking. The Rotork IQT redundant absolute encoder is contactless, has only one moving part and self-checking ability. Unlike existing absolute encoder designs, these technological breakthroughs increase position sensing reliability while providing zero-power position measurement.

Display

The advanced display allows large segment character position displays down to -50 °C while the matrix display provides detailed setting, status and diagnostic multilingual screens. The large display is backlit to provide excellent contrast even in the brightest ambient light conditions and is protected by a toughened glass window. An optional protective clip-in cover is available where high UV levels or abrasive environments are present.

Torque

IQ utilises a torque sensor developed and used successfully by Rotork for over 20 years. Torque generated when moving the valve produces a proportional thrust reaction on the motor worm-shaft. This thrust creates pressure in the piezo torque transducer which converts it to a voltage signal directly proportional to the output torque being produced by the actuator. The signal is used by the control circuit for torque limiting, real-time torque indication and for recording valve operating force profiles in the data logger. IQ torque sensing is simple, accurate and extremely reliable over the life of the actuator. Unlike other systems employed, IQ torque measurement has the advantage of being independent of voltage and temperature variations.

Control

Control elements such as main control and network interface cards, are connected using an internal bus system based on CAN, reducing wiring and connections for increased reliability.

Unrivalled Industry-leading Reliability

Valve operation must be reliable. Rotork IQ range actuators are engineered for a lifetime of uninterrupted service in the toughest applications. Built on the Rotork drive train, proven for over 60 years, IQ range actuators retain industry leading reliability:

- Advanced absolute position measurement allowing continuous position tracking even without power
- On power loss, graphical Interface, remote indication and data logger are maintained and accessible
- Extended life and mounting in any orientation with oil bath lubrication
- Water and dust ingress protection, not reliant on the terminal cover or cable gland sealing - double-sealed to IP66/68 at 20 m for 10 days
- Increased protection by using independent torque and position sensing
- Safe, motor-independent handwheel operation available at all times
- Explosionproof and certified for safety applications (SIL2/3)
- Drive bush bearings sealed for life - no maintenance required
- Backed by Rotork global support

Asset Management

With an advanced display, position, torque, status and configuration data is clear and immediately accessible. In addition the valve, actuator and process data is available in real-time on screen or in the control room. Valve stroke torque/thrust graphs, duty trend logs, vibration levels and valve & actuator manufacturing data can be extracted and stored as the basis for planned maintenance and operational activities, process performance characteristics and comparison.

Entire operations can now be performed in moments and data logger data downloaded using the Rotork Bluetooth® Setting Tool *Pro*. The data can be downloaded to a PC and analysed using Rotork Insight 2 software.

- Real-time valve and actuator performance information viewable on-screen
- Safe and secure data download via non-intrusive and intrinsically safe setting tool
- Field upgradeable and configurable control and indication options
- Compatible with *Pakscan* digital control and monitoring system plus all leading fieldbus networks
- Detailed trend analysis, diagnostics and data logger available, on-screen or downloadable via Bluetooth

Optimised for Preventative Maintenance

All IQ actuators incorporate a sophisticated data logger, which can provide comprehensive data capture and analysis for planned maintenance and troubleshooting issues with valves and processes. They capture:

- Valve torque profiles
- Operational starts profiles
- Operational, vibration and temperature trend logs
- Event log

Asset management data regarding the actuator and the valve is stored within the actuator and available for download. Specific asset management information includes:

- Running time
- Average torque
- Starts
- Life statistics

IQ actuators include configurable service / maintenance alarms. The alarm parameters are:

- Open torque levels
- Close torque levels
- Starts/hr
- Total starts
- Total turns
- Service intervals

Design Features

Indication Power

With the absolute encoder, a battery is not required for position sensing and tracking. As all configuration and data logger data is stored in non-volatile EEPROM memory, all settings are safe when no power is available. However, to maintain the display and ensure remote indication is kept updated, allow datalogging and power off commissioning, an indication battery is included as standard. Reduced power consumption means the battery has an exceptionally long life and low-cost replacements are available from suppliers globally. In addition, the auxiliary power module option is available, allowing the user to connect a 24 Volt supply to the actuator should communication with network systems be required when main actuator power is switched off.

Safe Manual Operation

In case of an emergency, power outage or failure of the control network, IQ actuators can be operated by hand. A manual clutch and handwheel allow an operator to disengage the motor and operate the valve independently, without risk of damage or injury.

Where the location requires it, the clutch can be padlocked into position to prevent accidental or unauthorised manual operation.

Manual movements of the valve are recorded and logged by the actuator. Position sensing in Rotork IQ actuators is highly reliable (power on or off) thanks to the unique robust and simple design of the absolute encoder.

Network System Connectivity

With the addition of an appropriate option card, the IQ actuator can be incorporated into a number of different fieldbus control systems. The IQ actuator can be utilised within the Rotork *Pakscan*™ control system, either wired or wirelessly, and the major open Fieldbus protocols including Profibus®, DeviceNet®, Foundation Fieldbus®, Modbus® and HART®.

Future-proofing

3rd generation IQ actuators have been designed with future advances in mind. In addition to highly configurable setup options they now feature flexible design technology.

Using the Rotork Insight 2 software and Rotork Bluetooth® Setting Tool *Pro*, it is also possible to apply updates to each actuator. This procedure is subject to four layers of security, with the option of disabling the Bluetooth communication for maximum security.

Remote Field Operation

The IQ Remote Hand Station uses the same display and controls interface from the IQ 3rd generation actuator, allowing users to remotely operate, interrogate and configure the IQ actuator from up to 100 m distance. Due to the familiar, feature rich interface, set up couldn't be simpler using the Rotork Bluetooth® Setting Tool *Pro* supplied with the IQ.

Duplicating the full functionality of the IQ, data logs can be viewed and downloaded locally at the Remote Hand Station (RHS) instead of gaining access to the actuator. Power for the RHS is supplied by the actuator, removing the need for supplementary power supplies.

- Installation using standard data cable, up to 100 metres away from the actuator
- Pole or wall mountable
- Replica of IQ 3rd generation user interface, including setup and configuration
- Powered via the attached actuator (24 VDC output)
- Explosionproof option available
- Enclosure IP66 / IP68
- Double-sealed
- Simple setup
- Actuator data logs available for viewing and downloading locally

IQ Thermostatic Protection

In the event of overheating, two thermostats embedded in the motor windings directly sense the temperature and trip the actuator control circuit.

Auto Self Test and Diagnosis (ASTD)

Vital operational circuits automatically self test to ensure correct operation. In the unlikely event that a fault is diagnosed the information is automatically presented on the display. At the same time, actuator operation can be inhibited to enable on-site investigation.

Instant Reversal Protection

When an actuator is ordered to reverse direction ‘instantaneously’ an automatic time-delay circuit avoids the shock loads which may cause unnecessary wear to valve stems and gearboxes. The delay also limits current surges through the contactor.

Syncrophase - Incorrect Wiring Protection

Rotork’s Syncrophase automatic phase rotation correction prevents valve damage caused by incorrect wiring by ensuring that the IQ 3-phase motor is always presented with the correct phase rotation. Syncrophase senses the incoming phase rotation then energises the appropriate contactor to cause movement in the correct direction.

Single Phasing Protection*

The IQ power module monitors all 3 phases of the power supply. Should one or more phases be lost the control system inhibits operation, preventing motor 'single phasing' and burn-out. The actuator display will indicate 'phase lost', remote indication is also available from the configurable indication contacts.

** IQ 3-phase only.*

Valve Jammed Protection

The actuator faces its severest operating duty during unseating of the valve, when operating forces are at their highest or where an infrequently operated valve can get stuck. IQ has the intelligence to systematically cope with these demands, ensuring reliable valve operation together with valve and actuator protection.

If valve “sticking” is considered possible, as with a wedge gate type, the torque switches can be by-passed during the a configurable portion of travel away from the valve seated position. This allows “extra” torque up to 1.5 times rated to be applied in unseating the valve. In the majority of cases, applying additional force causes the sticky valve to move and allows operation to continue. After the torque switch bypass set position has been reached, the torque switch returns to the set value for the rest of travel. If this additional torque is still insufficient to cause movement, IQ recognises the valve is jammed and stops operation within seconds preventing further valve damage or motor burn-out.

Design Features

Vibration Measurement

Vibration can severely affect plant equipment's performance and life and its effects are cumulative. Levels of vibration can vary significantly depending on process conditions such as start up and shut down, valve cavitation and at different flow rates making it difficult to capture with mobile measuring devices.

The IQ actuator includes a vibration sensor that measures and captures vibration levels in the range 10 Hz to 1 kHz (RMS average) and peak acceleration (maximum g) in 3 axis (x, y and z). Vibration trend logs can be viewed on the display or downloaded and viewed using Insight 2.

Local Diagnostics and Setup

The large dual stacked, high resolution display, with positional characters that are 25 mm high, is unrivalled in visibility for all lighting and orientation conditions. Consisting of a static, high-contrast positional display and a fully configurable dot-matrix LCD behind, the IQ range offers the easiest, user-friendly configuration and data analysis ever seen in the actuation world.

Configurable Home Screens

With a mixture of the static and dot-matrix displays, there are now four configurable home-screens available to the user. The four screens reflect the parameters most commonly required to analyse operation at-a-glance:

- Positional information with status
- Positional information with torque (digital)
- Positional information with torque (analogue)
- Positional information with input demand (digital and analogue)

Using the Rotork Bluetooth® Setting Tool *Pro*, each of these screens can be easily accessed with a press of a button. Alternatively you can select one of the four screens to be continually displayed in the setup menu.

User Friendly Setup Menus

A single press of a button on the Rotork Bluetooth® Setting Tool *Pro* takes you into the user-friendly setup menu. This menu has been designed and structured to reduce reliance on having a written manual to hand. With large, clear characters available in many languages, setup and configuration has never been so easy.

Lifetime Support

With communication featuring Bluetooth wireless technology, the onboard data logger and the new dual stacked display, the IQ range offers unrivalled support to provide complete product back up with local analysis and configuration. This is further supported up by the introduction of the new Insight 2 programme, which allows the user full access to configuration and data analysis. With Rotork's unrivalled worldwide service, network expert advice is always close to hand.

Remote Diagnosis - Bluetooth

The Rotork Bluetooth® Setting Tool *Pro* allows downloading of data logger and configuration files The tool also allows uploading of configuration and calibration data. The tool is intrinsically safe and can be used in hazardous areas. File transfer and data exchange is made using Bluetooth wireless technology between the actuator, the Rotork Bluetooth® Setting Tool *Pro* and a PC.

Graphical Data Logger

Greater amounts of data and analytical screens are now available in the data logger and viewable locally. The data logger screens are displayed on a 168 x 132 pixel dot-matrix display and can display anything from a torque vs position graph to statistical operational data.

Rotork Help – Online

Rotork has a comprehensive worldwide service network to provide you with local support wherever you are.

Rotork trained technicians working from our network of offices and centres of excellence are available to offer immediate assistance.

To contact Rotork, visit www.rotork.com

PC tools - Insight 2

Rotork Insight 2 facilitates the review, configuration and analysis of setup configuration and data logger information for Bluetooth enabled Rotork actuators. The visually interactive application is intuitive with clear menus making it a simple and fast process.

All Bluetooth enabled Rotork actuators include an onboard data logger. The data logger captures and stores valve, actuator, control signal operation and status data which can be viewed locally on the display or on a PC using Insight 2.

Log data is time and date stamped and can be viewed on an event by event basis. Insight 2 enables the user to pre-configure actuator missions on a PC, transfer them to a Rotork Bluetooth® Setting Tool *Pro* and transmit them to the actuator on-site. The missions can be dedicated to specific actuators by type or serial number and are password protected for extra security.

Standard missions include: extraction of actuator configuration and data logger, modification of actuator and option configuration.

Password protection is available on the Insight 2 software and actuators to prevent unauthorised or accidental modification of actuator configuration parameters.

Key Features

- View and modify actuator specification and configuration on PC
- Valve and actuator starts against position log
- Valve reference profile trend logs
- Valve torque profile, open/closed instantaneous and average torque against valve position
- View and modify option card configuration
- Operation and actuator control status log
- Pre-configure missions on a PC and transfer them to actuators in the field via the Rotork Bluetooth® Setting Tool *Pro*. Insight 2 requires a PC with a Bluetooth interface running Microsoft™ Windows XP or newer.

Battery Backup Solutions

IQT actuators can include an integral battery to perform a fail-to-position operation should mains power loss occur. The operating action is fully configurable to accommodate site shutdown processes.

The Shutdown Battery option comprises an integral Lithium Ion battery suitable for use in hazardous and safe environments. The Battery Backup option comprises a Lead Acid battery installed within the terminal enclosure for use in safe environments.

Mechanical Position Indication

IQ actuators can be installed in combination with a mechanical position indicator to show valve position. The mechanical position indicator comprises only mechanical parts with proven Rotork reliable design.

Refer to PUB002-137 for further details.

Plug and Socket

IQ range actuators can be supplied with a fully engineered plug and socket interface to provide fast connection and disconnection in the field. Plug and socket facilitates field wiring in advance to improve commissioning speed and efficiency.

The IQ plug and socket option maintains the IP68 rating (20 m for 10 days) and is certified for use in hazardous areas.

Refer to PUB002-127 for further details.

Rotork *Master Station* - Network Capabilities

Redundant Host Ethernet Modbus TCP connection as standard with optional redundant Host serial Modbus RTU connection available.

Pakscan Classic field network Add In Module (AIM)

The *Pakscan* Classic redundant loop network has been the network of choice for actuator control for over 30 years. Using robust current loop technology, up to 20 km loop lengths and 240 field devices are possible.

Modbus field network Add In Module (AIM)

Modbus field network with standard highway or redundant loop topology options. Other manufacturers devices integrated into the network by use of a Rotork field device description file.

Fieldbus Compatibility

IQ actuators are compatible with most industry standard fieldbus systems as well as Rotork's own *Pakscan* system.

- Compatibility via network cards that are fitted in the main electronics enclosure
- Full integration with your existing plant control systems

Pakscan™

Modbus®

FOUNDATION

HART COMMUNICATION PROTOCOL

PROFIBUS

DeviceNet CONFORMANCE TESTED

IQ range actuators perform unfailingly in environments ranging from desert to tundra, offshore to underground, where flooding, humidity, extremes of heat and cold, ultraviolet and corrosive atmospheres are the norm.

IQ actuators have a record of reliability and safety that is second to none.

Actuator Specification

The following pages contain details on performance and specification for the Rotork IQ range of actuators.

Please use the following contents table to help access the information you require.

Performance Summary

IQT, IQTM and IQTF - Performance Data

Actuator	IQTF50	IQTF100	IQT125 IQTF125 IQTM125	IQT250 IQTF250 IQTM250	IQT500 IQTF500 IQTM500	IQT1000 IQTF1000 IQTM1000	IQT2000 IQTF2000 IQTM2000	IQT3000 IQTF3000 IQTM3000
Seating Torque		Torque	Nm	lbf.ft				
	50	100	125	250	500	1,000	2,000	3,000
	37	74	92	185	369	738	1,476	2,214
Modulating Torque - IQTM and IQTF only								
	25	50	63	125	250	500	1,000	1,000
	19	37	46	93	185	369	738	738
Operating Time (seconds) - IQT and IQTM only								
90° Min	–	–	5	8	15	30	60	60
90° Max	–	–	20	32	60	120	240	120
Operating Speed - IQTF only								
rpm	2.5 - 10	1.5 - 6	0.75 - 3	0.5 - 1.88	0.25 - 1	0.125 - 0.5	0.125 - 0.5	0.125 - 0.5
max turns, min rpm	22	22	12	7.5	3.75	1.88	1.88	1.88
max turns, max rpm	22	22	22	22	15	8	4	4

IQT/IQTM/IQTF actuator output torque is configurable to 40 - 100% of seating torque.
Operating speed of IQT/IQTM/IQTF 24 VDC actuators will vary with load.

IQTF L - Performance Data

	Stem Lead	Rated Thrust		Max Stroke		Max Speed	Min Speed
Actuator size	mm	kN	lbf	mm	in	mm/sec	mm/sec
IQTF50 L	3	23.45	5,271	66	2.60	0.50	0.13
	5	20.88	4,695	110	4.33	0.83	0.21
	7	18.82	4,232	153	6.02	1.17	0.29
IQTF100 L	3	46.90	10,543	66	2.60	0.30	0.08
	5	41.77	9,389	110	4.33	0.50	0.13
	7	37.65	8,463	153	6.02	0.70	0.18
IQTF125 L	5	37.89	8,518	110	4.33	0.25	0.06
	7	35.10	7,891	153	6.02	0.35	0.09
	10	31.61	7,107	153	6.02	0.50	0.13
	15	27.03	6,077	153	6.02	0.75	0.19
IQTF250 L	5	75.78	17,036	110	4.33	0.16	0.04
	7	70.21	15,783	153	6.02	0.22	0.05
	10	63.23	14,214	153	6.02	0.31	0.08
	15	54.06	12,154	153	6.02	0.47	0.12

In accordance with ISO 22153, thrust is calculated using a constant value coefficient of friction (CoF). CoF can vary with load, speed and lubrication.
Refer to PUB002-065 for the recommended lubrication routine.

Performance Summary

IQT, IQTM and IQTF - Mechanical Data

Actuator	IQTF50	IQTF100	IQT125 IQTF125 IQTM125	IQT250 IQTF250 IQTM250	IQT500 IQTF500 IQTM500	IQT1000 IQTF1000 IQTM1000	IQT2000 IQTF2000 IQTM2000	IQT3000 IQTF3000 IQTM3000
Approximate weight								
kg	22	22	22	22	22	37	37	39
lbs	49	49	49	49	49	82	82	86
Handwheel details								
Turns for 90°	26	26	88	88	88	83	83	83

Type B Coupling - Torque only

Bore & key max mm	F05*	F07*	F10	F05*	F07*	F10	F05*	F07*	F10	F07*	F10	F10	F12	F14	F14	F16
Bore & key max in	FA05*	FA07*	FA10	FA05*	FA07*	FA10	FA05*	FA07*	FA10	FA07*	FA10	FA10	FA12	FA14	FA14	FA16
Square AF max mm	22	28	42	22	28	42	22	28	42	28	42	42	60		60	60
Square AF max in	0.87	1.1	1.65	0.87	1.1	1.65	0.87	1.1	1.65	1.1	1.65	1.65	2.36		2.36	2.36
Shaft height max mm	14	19	32	14	19	32	14	19	32	19	32	32	41		41	46
Shaft height max in	0.56	0.75	1.25	0.56	0.75	1.25	0.56	0.75	1.25	0.75	1.25	1.25	1.62		1.62	1.81
Shaft height max mm	65	65	45	65	65	45	65	65	45	65	45	45	65		65	80
Shaft height max in	2.56	2.56	1.77	2.56	2.56	1.77	2.56	2.56	1.77	2.56	1.77	1.77	2.56		2.56	3.15

* Optional flanges F05, FA05, F07 and FA07 use a base adapter plate. Required base type must be specified.

Type A Coupling - Torque and Thrust

ISO 5210	F10	F10	F14	F14	-	-	-	-
MSS SP-101	FA10	FA10	FA14	FA14	-	-	-	-
Thrust rating kN	44	44	100	100	-	-	-	-
Thrust rating lbf	10,000	10,000	22,480	22,480	-	-	-	-
Max rising stem diameter mm	32	32	44	44	-	-	-	-
Max rising stem diameter in	1.25	1.25	1.7	1.7	-	-	-	-
Extra weight kg	10	10	25	25	-	-	-	-
Extra weight lbs	22	22	55	55	-	-	-	-

Type L Coupling - Linear Thrust

ISO 5210	F10	F10	F14	F14	-	-	-	-
Coupling	M20 x 1.5	M20 x 1.5	M36 x 3	M36 x 3	-	-	-	-
Extra weight kg	10	10	25	25	-	-	-	-
Extra weight lbs	22	22	55	55	-	-	-	-

The linear drive coupling is available with an additional yoke if required. F10 linear drive with yoke is 13 kg (28.7 lbs). F14 linear drive with yoke is 33 kg (72.8 lbs).

2 Actuator Drive Couplings

2.1 IQ and IQT Drive Couplings

The IQ range features a removable base and coupling for all sizes. Flanges and couplings comply with ISO 5210 or MSS SP-102. Other base interfaces are available – apply to Rotork for details.

Drive Couplings

The removable drive bushes are supplied blank or pilot bored for machining to suit valve stem.

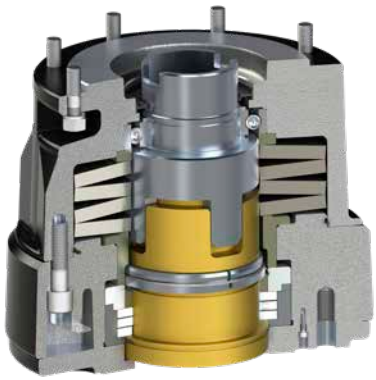
Thrust Bearings

Type 'A' and 'Z3' couplings include a fully sealed and lubricated-for-life thrust bearing. The thrust bases are designed to retain all the developed valve thrust reaction forces without any thrust load being transmitted to the actuator gearcase.

2.2 Thrust (Temperature) Compensation - Coupling T

For applications when valve stem expansion (caused by temperature change), within the valve body, can generate excess thrust and cause the valve to become damaged, Rotork offer a thrust compensator. This limits thrust and prevents damage, while maintaining a sufficient level to prevent leaking.

F10 Type A thrust base assembly.



Thrust compensator.

F14 and F16 Type A thrust base assembly.

F25 and F30 Type A thrust base assembly.

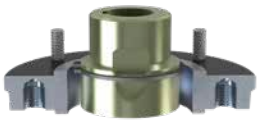
Actuator Drive Couplings

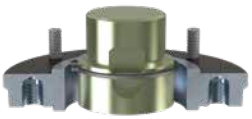
IQ Actuator Drive Couplings

All size IQ actuators

Thrust	**Type A**	**Type Z3** Increased reach

Non-Thrust	Large fixed bore with ISO standard bore and keyway **Type B1**	Fixed bore with ISO standard bore and keyway **Type B3**	Blank drive bush for machining by customer **Type B4**



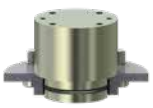


IQT Actuator Drive Couplings

All size IQT actuators

Thrust	**Type A**	**Type L** **Linear**

Non-Thrust	**Type B**			
	F05/FA05 and **F07/FA07**	**F10/FA10**	**F12/FA12** and **F14/FA14**	**F16/FA16**



Standard Specifications

3 Introduction

IQ range actuators are self-contained, purpose designed and built for the local and remote electrical operation of valves. Comprising an electric motor, reduction gearing, reversing starter with local controls and indication, turns and torque limitation with electronic logic controls and monitoring facilities housed in a double-sealed watertight enclosure. Hazardous area certified enclosures meeting international and national requirements are also available.

All torque, turns settings and configuration of the indication contacts are made using the non-intrusive, handheld Rotork Bluetooth® Setting Tool *Pro*.

The specifications in this section cover IQ range standard and optional features. Enclosure requirements and selected build options must be specified at time of enquiry.

4 Design Specification

The IQ range of actuators comply, where applicable, with the following International, European and USA standards.

Standard	Title
ISO 22153	Electric actuators for industrial valves — General requirements
ISO 22109	Industrial valves – Gearboxes for valves
ISO 5210	Industrial valves — Multi-turn valve actuator attachments
ISO 5211	Industrial valves — Part-turn valve actuator attachments
ISO 12490	Petroleum and natural gas industries — Mechanical integrity and sizing of actuators and mounting kits for pipeline valves
EN 15714-2	Industrial valves - Actuators - Part 2: Electric actuators for industrial valves - Basic requirements
EN 12570	Industrial valves. Method for sizing the operating element
ANSI/ISA SP96.02	Guidelines for the Specification of Electric Valve Actuators
MSS SP-102	Multi-Turn Valve Actuator Attachment - Flange and Driving Component Dimensions and Performance Characteristics.
MSS SP-101	Part-Turn Valve Actuator Attachment - Flange and Driving Component Dimensions and Performance Characteristics
AWWA C542	Electric motor actuators for valves and slide gates

Standard Specifications

4.1 Duty Rating

The below table provides duty ratings for IQ range multi-turn, part turn and linear output actuators.

ISO 22153 duty requirements were developed specifically for electric valve actuators and define load, cycle and start requirements. Duty performances vary with torque and thrust. When actuator operating performance increases, the required duty decreases, reflecting the operational requirements of valves.

The referenced "S" duties, in accordance with IEC 60034-1 (Rotating electrical machines – duty and performance), do not accurately reflect variable valve operating load profiles imposed on actuators. As such IEC 60034-1 is not directly comparable and is included for information only.

Actuator Type [1]	Duty Class (ISO 22153)	Rotork Duty Rating [2]
IQ / IQS / IQD	A, B (On-Off – Inching)	15 minutes (S2-15 min / S3 25%) based on 60 starts per hour at a rate of up to 600 starts per hour [3]
IQM / IQML	C (Modulating)	1,200 starts per hour (S4-50%) [3]
IQT	A, B (On-Off – Inching)	60 cycles / 120 starts per hour at rate of up to 600 starts per hour (S2-15 min / S3 25%) [3]
IQT	C (Modulating)	1,200 starts per hour (S4-50%) [4]
IQTM / IQTF	C (Modulating)	1,800 starts per hour (S4-50%)

Notes:
1 Duty achieved by actuators with performances referenced in Section 1.
2 ISO 22153 defines duty load, cycle and start requirements.
3 Availability subject to model, torque, speed and voltage limitations. Other duties are available subject to torque and thrust requirement. Apply to Rotork.
4 When controlled by analogue or network positioning signal.

4.2 Design Life (Endurance)

IQ range actuators meet or exceed the endurance requirements of ISO 22153. The table below details the IQ range design qualification endurance tests.

IQ Output Type [1]	Duty Class (ISO 22153)	Torque / Thrust	Rotork Endurance Test [2]
Multi-turn	A, B (Isolating - Inching)	≤700 Nm (516 lbf.ft)	10,000 cycles (500,000 output turns) / 33% rated torque
		701 - 3,000 Nm (517 - 2,212 lbf.ft)	5,000 cycles (250,000 output turns) / 33% rated torque
	C (Modulating)	≤544 Nm (401 lbf.ft)	1,800,000 starts / 50% rated torque
Part-turn	A, B (Isolating - Inching)	≤2,000 Nm (1,475 lbf.ft)	25,000 cycles / 75% rated torque
		3,000 Nm (2,212 lbf.ft)	10,000 cycles / 50% rated torque
	C (Modulating)	≤2,000 Nm (1,475 lbf.ft)	1,800,000 starts / 50% rated torque
		3,000 Nm (2,212 lbf.ft)	1,800,000 starts / 33% rated torque
Linear	A, B (Isolating - Inching)	≤100 kN (22,480 lbf)	10,000 cycles / 33% rated thrust
	C (Modulating)	≤100 kN (22,480 lbf)	1,800,000 starts / 50% rated thrust

Notes:
1 Endurance achieved by actuators with performances referenced in Section 1.
2 ISO 22153 defines endurance load, cycle and start requirements.

Standard Specifications

4.3 Vibration, Shock and Noise

Standard IQ range actuators are suitable for applications where vibration and shock severity does not exceed the following:

Type	Level
Plant induced vibration	1g RMS total for all vibration within the frequency range of 10 to 1,000 Hz
Shock	5g peak acceleration
Seismic	2g acceleration over a frequency range of 1 to 50 Hz if it is to operate during and after the event
Emitted noise	Independent tests have shown that at 1m generated noise does not exceed 70 db (A)

Levels quoted are those present at the actuator mounting interface. It should be noted that the effects of vibration are cumulative and therefore an actuator subjected to significant levels may have a reduced lifespan. Where excessive plant induced vibration is anticipated, mounting the actuator remote from the valve and driving via extension shafting (incorporating vibration absorbing couplings) may provide a satisfactory solution.

The IQ includes a vibration sensor that measures and captures vibration levels in the range 10 Hz to 1 kHz (RMS average) and peak acceleration (maximum g) in 3 axis (x, y and z). Vibration trend logs averaged over one hour can be viewed on the display or downloaded and viewed using Insight 2.

4.4 Valve / Actuator Interface

The IQ range of actuators are available with mounting base and output drive couplings conforming to the following international standards:

Valve to actuator interface:

Valve type	Actuator Range	Area	Standard	Code
Multi-turn	IQ	International	ISO 5210	"F" metric
Multi-turn	IQ	USA	MSS SP-102	"FA" imperial
Part-turn	IQ + ¼ turn gearbox	International	ISO 5211	"F" metric
Part-turn	IQ + ¼ turn gearbox	USA	MSS SP-101	"FA" imperial
Part-turn	IQT	International	ISO 5211	"F" metric
Part-turn	IQT	USA	MSS SP-101	"FA" imperial

Actuator Orientation:

Actuators can be mounted in any orientation. The user/installer is responsible for considering the effects of orientation and subsequent loading on the supporting pipework and valve structure including any interface adaption kits.

4.5 Operating Temperature

Actuators are suitable for operation within the ambient temperature ranges shown below. Refer to Section 5 for Hazardous Area Certification operating temperature restrictions. For temperatures outside this range please contact Rotork. Prior to installation actuators should be stored in a dry location with a temperature range not exceeding -60 to 80 °C (-76 to 176 °F).

Actuator Type	Standard Temperature[1]	Low Temperature Option[1]
IQ, IQM, IQML	-30 to +70 °C (-22 to +158 °F)	Refer to Section 5
IQS, IQD	-20 to +70 °C (-4 to +158 °F)	Not available
IQT / IQTM / IQTF	-30 to +70 °C (-22 to +158 °F)	-50 to +40 °C (-58 to +104 °F)

Note:
1 Hazardous Area certification determines permissible operating temperature range. Refer to Section 5.

5 Non-Hazardous & Hazardous Certified Enclosures

All IQ actuator hazardous and non-hazardous area enclosures are watertight to IP68/NEMA Type 4 & 6. The Rotork double-sealed terminal compartment features a seal at the terminal cover and a separate seal at the terminal bung. This results in the actuator internals being completely sealed from the environment for life, even with the terminal cover removed. Through the use of non-intrusive commissioning and adjustment using the Rotork Bluetooth® Setting Tool *Pro*, covers never need removing and therefore the hermetic, factory-sealed enclosure protects internal components for life. In addition, the Rotork Bluetooth® Setting Tool *Pro* is certified Intrinsically Safe permitting power-on commissioning in hazardous areas.

Actuators are available with the following enclosure types for which the ambient working temperature ranges are stated. Where option temperatures are indicated, changes to some actuator components are required and therefore the temperature requirement must be specified. Hazardous area approvals for other country standards are available; please contact Rotork.

IQ actuators are available built in accordance with the following standards:

5.1 Non-Hazardous Area Enclosures

WT: Standard Watertight

Standard	Rating	Standard Temperature	Option 1	Option 2	Option 3
IEC 60529 (1989-11)	IP66/IP68-20 m / 10 days	-30 to +70 °C	-40 to +70 °C	-50 to +40 °C	n/a
BS EN 60529 (1992)	IP66/IP68-20 m / 10 days	-30 to +70 °C	-40 to +70 °C	-50 to +40 °C	n/a
NEMA (US)	Type 4, 4X & 6	-22 to +158 °F	-40 to +158 °F	-58 to +104 °F	n/a
CSA (Canadian)	Type 4, 4X & 6	-22 to +158 °F	-40 to +158 °F	-58 to +104 °F	n/a
EAC (Russia)	IP66/IP68-20 m / 10 days	-30 to +70 °C	-40 to +70 °C	-50 to +40 °C	-61 to +40 °C

Standard Specifications

5.2 Hazardous Area Enclosures

European Hazardous Area Directive – ATEX (2014/34/EU)

Directive Code	Enclosure Code	Standard Temperature	Temperature Option 1	Temperature Option 2	Temperature Option 3
ATEX II 2GD c	**Ex d IIB T4 (T6[1]) Ex d IIC T4 (T6[1]) Ex tb IIIC T120°C (T80°C[1])**	-20 to +70 °C (-4 to +158 °F)	-30 to +70 °C (-22 to +158 °F)	-40 to +70 °C (-40 to +158 °F)	-50 to +40 °C (-58 to +104 °F)
ATEX II 2GD c	**Ex de IIB T4 (T6[1]) Ex de IIC T4 (T6[1]) Ex tb IIIC T120°C (T80°C[1])**	-20 to +70 °C (-4 to +158 °F)	-30 to +70 °C (-22 to +158 °F)	-40 to +70 °C (-40 to +158 °F)	-50 to +40 °C (-58 to +104 °F)

International Hazardous Area – IECEx

Enclosure Code	Standard Temperature	Temperature Option 1	Temperature Option 2	Temperature Option 3
Ex d IIB T4 (T6[1]) Ex d IIC T4 (T6[1]) Ex tb IIIC T120°C (T80°C[1])	-20 to +70 °C (-4 to +158 °F)	-30 to +70 °C (-22 to +158 °F)	-40 to +70 °C (-40 to +158 °F)	-50 to +40 °C (-58 to +104 °F)
Ex de IIB T4 (T6[1]) Ex de IIC T4 (T6[1]) Ex tb IIIC T120°C (T80°C[1])	-20 to +70 °C (-4 to +158 °F)	-30 to +70 °C (-22 to +158 °F)	-40 to +70 °C (-40 to +158 °F)	-50 to +40 °C (-58 to +104 °F)

USA Hazardous Area – Factory Mutual Certified Explosionproof to FM3600, FM3615 and FM3616
USA Hazardous Area – cCSAus Certified Explosionproof to FM3600, FM3615 and FM3616
Canadian Hazardous Area – Canadian Standards Association (CSA EP) to C22.2 No. 25 and C22.2 No. 30-M

Class	Division	Groups	Standard Temperature	Temperature Option 1	Temperature Option 2
I II	**1 1**	C, D, E, F, G	-22 to +158 °F (-30 to +70 °C)	-40 to +158 °F (-40 to +70 °C)	-58 to +104 °F (-50 to +40 °C)
I II	**1 1**	B, C, D, E, F, G	-22 to +158 °F (-30 to +70 °C)	-40 to +158 °F (-40 to +70 °C)	-58 to +104 °F (-50 to +40 °C)

EAC (Russia) – Ex

Enclosure Code	Standard Temperature	Temperature Option 1	Temperature Option 2	Temperature Option 3
Ex d IIB T4 (T6[1]) Ex d IIC T4 (T6[1]) Ex tb IIIC T120°C (T80°C[1])	-20 to +70 °C (-4 to +158 °F)	-30 to +70 °C (-22 to +158 °F)	-40 to +70 °C (-40 to +158 °F)	-61 to +40 °C (-78 to +104 °F)
Ex de IIB T4 (T6[1]) Ex de IIC T4 (T6[1]) Ex tb IIIC T120°C (T80°C[1])	-20 to +70 °C (-4 to +158 °F)	-30 to +70 °C (-22 to +158 °F)	-40 to +70 °C (-40 to +158 °F)	-61 to +40 °C (-78 to +104 °F)

Note:
1 Applies to IQT range only

Standard Specifications

Rotork Bluetooth® Setting Tool *Pro* Certification

Directive / Standard	Rating	Standard Temperature
ATEX II 1G	**Ex ia IIC T4**	-30 to +50 °C (-22 to +122 °F)
FM3610	**Intrinsically Safe Class I, Div 1 groups A,B,C,D: T4**	-30 to +50 °C (-22 to +122 °F)
Canada CSA – C22.2 No.157-92	**Exia - Intrinsically Safe Class I, Div 1 groups A,B,C,D: T4**	-30 to +50 °C (-22 to +122 °F)

Marine Approval

Actuator Type	Approval	Certificate
IQ	**Lloyd's Register Mutual Recognition Type Approval**	16/ 00066
IQT, IQTM, IQTF	**Lloyd's Register Mutual Recognition Type Approval**	18/ 00005

6 Regulatory Standards

Compliance with the following European Economic Community Directives permits IQ range actuators to be CE marked under the provision of the Machinery Directive.

Directive	Applicable to	Reference
Electromagnetic compatibility (EMC)	**Immunity to / emissions of electromagnetic energy**	2004/108/EC
Low voltage (LV)	**Electrical safety**	2006/95/EC
Machinery[1]	**Product safety**	Actuators follow the provision of the Machinery Directive 2006/42/EC. The IQ must not be put into service until the equipment into which it is being incorporated has been declared to be in conformity with the provisions of the European Community Machinery Directive 2006/42/EC.
Waste Electrical Equipment (WEE)	**Exempt under the scope of the directive**	
Federal Communications Commission	**Bluetooth modules - actuator and Rotork Bluetooth® Setting Tool *Pro*.**	Contains FCC certified transmitter module. Refer to PUB002-039 for FCC ID.

Note:

1 Actuators are not classified as machines within the scope of the machinery directive. Contact Rotork for a copy of our Declaration of Conformity and Incorporation.

Standard Specifications

7 Power, Control & Indication

7.1 Power Supplies

IQ actuators are suitable for operation with the following 1-phase, 3-phase and DC power supplies:

Standard supply voltage ranges – actuator availability

IQ Actuator – 3-phase

Actuator Size	10	12	18	19	20	25	35	40	70	90	91	95
rpm	Voltage Availability											
18	A	A	A	A	A	A	A	C	C	C	–	–
24	A	A	A	A	A	A	A	C	C	C	–	C
36	A	A	B	A	A	A	A	C	C	C	–	–
48	A	A	B	A	A	A	A	C	C	C	–	–
72	A	A	B	A	A	A	A	C	C	C	–	–
96	A	A	B	–	A	A	A	C	C	C	–	–
144	–	–	B	–	A	A	A	C	C	C	C	–
192	–	–	B	–	–	B	B	–	C	C	C	–

Group A **50 Hz:** 190, 415, 500 V. **60 Hz:** 230, 460, 600 V. **50/60 Hz:** 200, 208, 220, 240, 380, 400, 440, 480, 575, 660, 690 V
Group B **50 Hz:** 380, 400, 415, 440 V. **60 Hz:** 460, 480 V
Group C **50 Hz:** 380, 400, 415, 440, 500, 660, 690 V. **60 Hz:** 480, 600 V
Additional voltages are available for specific speeds and/or duty, refer to PUB002-099 or contact Rotork for more information.

IQM, IQML Actuators – 3-phase

Actuator Size	10	12	20	25	35
rpm	Voltage Availability				
18	A	A	A	A	B
24	A	A	A	A	B
36	A	A	A	A	B
48	A	A	A	A	B
72	–	–	A	A	B

Group A **50 Hz:** 190, 415 V. **60 Hz:** 230, 460 V. **50/60 Hz:** 200, 208, 220, 240, 380, 400, 440, 480 V
Group B **50 Hz:** 380, 400, 415 V. **60 Hz:** 440, 460, 480 V
Additional voltages are available for specific speeds and/or duty, refer to PUB002-120 or contact Rotork for more information.

IQS Actuator – 1-phase

Actuator Size	12	20	35
rpm	Voltage Availability		
18	A	A	B
24	A	A	B
36	A	A	B
48	A	A	B
72	A	A	B
96	A	A	B
144	-	A	B

Group A **50/60 Hz:** 110, 115, 120, 220, 230, 240 V
Group B **50/60 Hz:** 220, 230, 240 V
Refer to PUB002-119 or contact Rotork for more information.

IQD Actuator – DC

Actuator Size	10	12	18	20	25
rpm	Voltage Availability				
18	A	B	-	C	C
24	A	B	B	C	C
36	A	B	-	C	C
48	A	B	-	C	C

Group A 24, 48, 110 V
Group B 48, 110 V
Group C 110 V
Refer to PUB002-121 or contact Rotork for more information.

Tolerances

Voltage Tolerance	+/-10%	Applies to rated torque performance only; duty cycle and speed is not guaranteed
Frequency Tolerance	+/-5%	Applies to rated torque performance only; duty cycle and speed is not guaranteed
Non-standard tolerances	For tolerances larger than those quoted, contact Rotork	
Uninterruptable power supplied	For AC systems the UPS output should conform to recognised supply standards such as BS EN 50160 in respect of waveform, harmonics etc.	

IQT, IQTM, IQTF Actuators

Actuator Size	50	100	125	250	500	1000	2000	3000
Voltage	Voltage Availability							
DC – 24 V	✓	✓	✓	✓	✓	✓	✓	✗
1-Phase 50/60 Hz: 100, 110, 115, 120, 208, 220, 230, 240 V	✓	✓	✓	✓	✓	✓	✓	✓
3-Phase 50/60 Hz: 200, 208, 220, 230, 240, 380, 400, 415, 440, 460, 480, 500, 550, 575, 590, 600, 660, 690 V	✓	✓	✓	✓	✓	✓	✓	✓

Standard Specifications

7.2 HMI, Local Control, Indication & Set-up

The high resolution LCD display has a wide viewing angle making it easily legible from a distance. The LCD display operates from -50 °C up to +70 °C.

Non-intrusive selectors are provided on the actuator electrical control cover which also includes a window showing actuator position, status and alarm display.

The control cover may be rotated through 360° (90° increments) to suit actuator orientation/operator access. Set-up is over a Bluetooth interface using the supplied Rotork Bluetooth® Setting Tool *Pro*.

Standard local controls

Operation	Type	Function	Comments
Position	Red, rotary selector	Selects "Local", "Stop" or "Remote" control	Can be padlocked in each position (stop remains available) for site operational protection
Local control	Black, rotary selector	Initiates local "Open" and "Close" operation	Spring-return to centre neutral position. Local control may be user configured for inching action
Bluetooth	Rotork Bluetooth® Setting Tool *Pro*	Initiates local "Open" and "Close" operation	May be user configured for Bluetooth operation over a nominal distance of 10 m (30 ft)

Standard local indication

Operation	Type	Function	Comments
Position indication	LCD - Large character (25 mm/1")	Close icon – 0-99% (0.1% increments) – Open Icon	Back-lit (power on) – operating temperature range -50 to +70 °C (-58 to +158 °F). Battery supported power off
Position indication	Coloured indication lights	Green (close), Red (open) Yellow (mid-travel)	Power on – lamp indication, colours can be reversed. Blinker and alarms can be configured to indicate
Status and Alarm (multi-language)	LCD – position display status and alarm text	Real time status and alarm text integrated into position display	Power on – battery supported (when awake)
Status and Alarm (multi-language)	LCD – text display	Real time status and alarm text via status	Power on – battery supported (when awake)
Status and Alarm (multi-language)	General alarm Battery alarm	Display icons	At a glance indication, detail provided by status/alarm text

Standard Specifications

7.2 HMI, Local Control, Indication & Set-up cont.

IQ range actuators are set up using the non-intrusive Rotork Bluetooth® Setting Tool *Pro*. Torque levels, position limits, control and indication functions can all be accessed using the intrinsically safe, wireless handheld setting tool.

Bluetooth wireless connectivity allows easier use without direct line-of-sight and over greater distances, however security has to match. This is achieved by the initial 'pairing' of tool and actuator being carried out by a single infra-red transaction after which a Bluetooth wireless connection automatically takes over. As before, configuration changes are password protected and the actuator is immune to connection by non-Rotork devices or programmes.

IQ range actuators benefit from advances in human interface design. In addition to a configurable, information-rich display, they offer a highly intuitive menu system for commissioning, updates and diagnostics.

Rotork Insight 2 software facilitates actuator setup by pre-defining complete sets of instructions and settings. Each collection of settings can be saved as a 'mission' and quickly applied to individual actuators via the handheld Rotork Bluetooth® Setting Tool *Pro*.

IQ actuators can be interrogated and set up even when mains power is not available; the actuator can be configured and interrogated by using power from its display back-up battery.

Actuator Set-Up, Configuration & Datalogging

Setting Tool & LCD displays	Simple non-intrusive, interactive set-up procedure using supplied Rotork Bluetooth® Setting Tool *Pro* with read-back from LCD's. Settings include limits & torque, indication contacts and control options. Settings may be password protected.
PC/PDA	Using freeware Insight 2, actuators may be configured / analysed over Bluetooth interface.
Datalogging	Standard onboard data logger provides valve torque and starts profiles, operational statistics, events log. Actuator configuration and manufacturing data also available. Files can be downloaded direct to PC or to Rotork Bluetooth® Setting Tool *Pro* (IS certified) for transport to office PC. Freeware Insight 2 for PC is available to download at www.rotork.com

Options

Vandal resistant	**Option 1:** Red / black control selectors not fitted	**Option 2:** Lockable cover protects standard selectors and window

Reference documents

Refer to PUB002-039 for details of status and alarm text messages, alarm icons, help screens and actuator set up procedure.
Refer to PUB095-001 for Rotork Bluetooth® Setting Tool *Pro* manual.

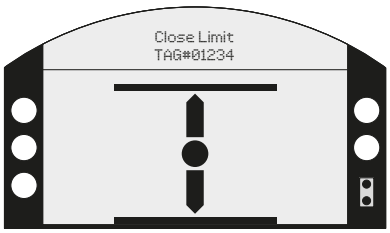
7.2.1 Local Diagnostics and Setup

The large dual stacked, hi-resolution display, with positional characters that are 25 mm high, is unrivalled in visibility for all lighting and orientation conditions. Consisting of a static, high-contrast positional display and a fully configurable dot-matrix LCD behind, the IQ range offers the easiest, user-friendly configuration and data analysis ever seen in the actuation world.

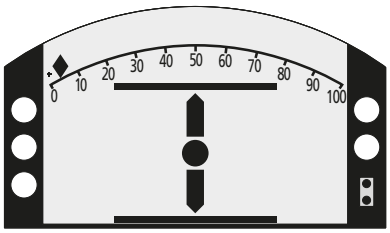
7.2.2 Configurable Home Screens

With a mixture of the static and dot-matrix displays, there are now four configurable home-screens available to the user. The four screens reflect the parameters most commonly required to analyse operation at-a-glance:

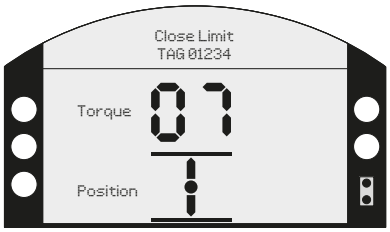
- Positional information with status



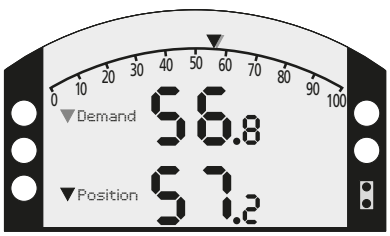
- Positional information with torque (analogue)



- Positional information with torque (digital)



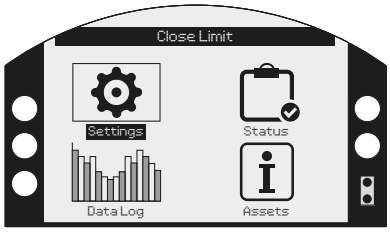
- Positional information with input demand (digital and analogue)

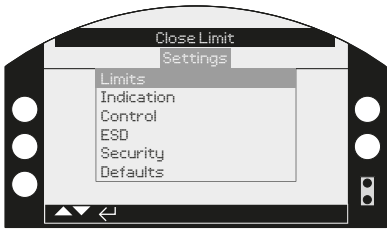


Using the Rotork Bluetooth® Setting Tool *Pro*, each of these screens can be easily accessed with a press of a button. Alternatively you can select one of the four screens to be continually displayed in the setup menu.

7.2.3 User Friendly Setup Menus

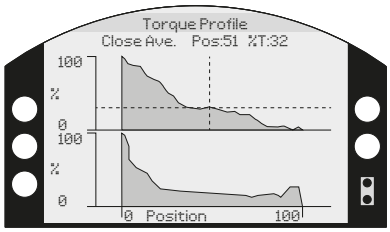
A single press of a button on the Rotork Bluetooth® Setting Tool *Pro* takes you into the user-friendly setup menu. This menu has been designed and structured to reduce reliance on having a written manual to hand. With large, clear characters available in many languages, setup and configuration has never been so easy.

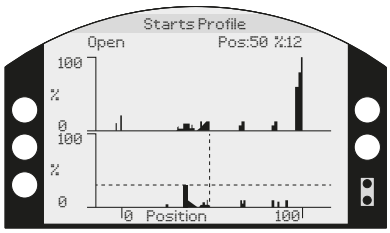




7.2.4 Graphical Data Logger

Greater amounts of data and analytical screens are now available in the data logger and viewable locally. The data logger screens are displayed on a 168 x 132 pixel dot-matrix display and can display anything from a torque vs position graph to statistical operational data.

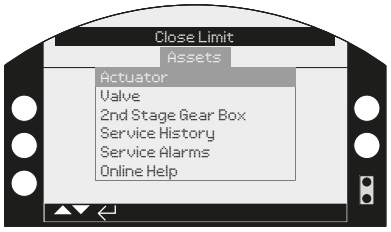




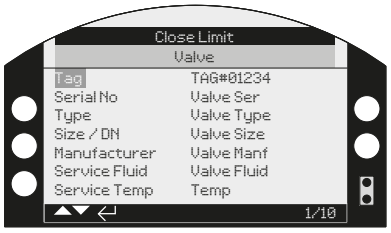
7.2.5 Asset Management

Not only can you store information relating to the actuator, but also the valve and gearbox. This includes data about build (class, size, ratio and tag numbers) along with service information (commission date, service date etc).

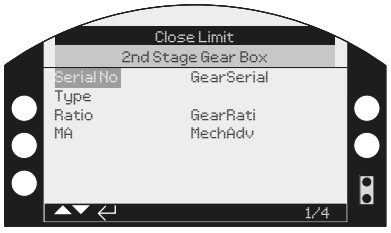
- Actuator data



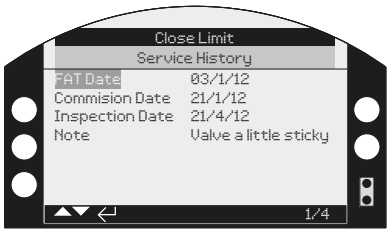
- Valve data



- Gearbox data



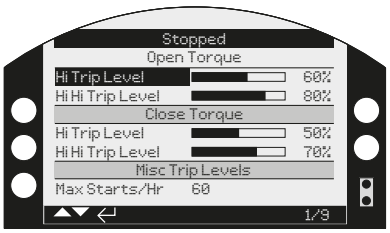
- Service history



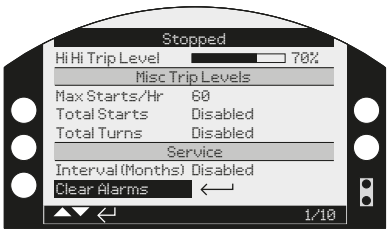
7.2.6 Configurable Service Alarms

To help optimise preventative maintenance, the 3rd generation IQ now includes configurable service / maintenance alarms. The alarm parameters include:

- Open torque levels
- Close torque levels

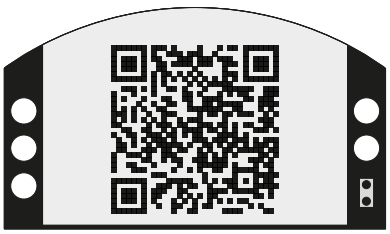


- Miscellaneous trip levels:
  - Starts/Hr
  - Total starts
  - Total turns
  - Service intervals



7.2.7 QR Code – 2d Barcode

A QR (Quick Response) code or 2d barcode can be generated on the dual stacked display, which can be scanned with a Smartphone. This enables the user a quick link to the Rotork website for further information and online help.



7.2.8 Rotork Help – Online

Rotork has a comprehensive worldwide service network to provide you with local support wherever you are. Rotork trained technicians working from our network of offices and centres of excellence are available to offer immediate assistance.

To contact Rotork, visit www.rotork.com

Standard Specifications

7.3 Remote Control & Indication

IQ range actuators enable remote control and indication of valves for centralised control. Actuator control and indication forms are available to meet the requirements of the various site control systems, from simple manual push-button control through to sophisticated Distributed Control Systems (DCS) using relay outputs or digital "bus" network systems.

Standard remote controls

Operation	Type	Range	Comments
Open/Close/ Maintain Common	Positive switched 3 x opto-isolated inputs designed for fleeting or maintained contacts	20 - 60 VDC, 40 - 120 VAC	Actuator derived 24 VDC (120 VAC available as an option) or externally supplied derived from the control system. Various forms available.
ESD Open interlock Close interlock Common	Positive switched 3 x opto-isolated inputs designed for maintained contacts.	20 - 60 VDC, 40 - 120 VAC	ESD can be user configured open, stayput or close, from an NO or NC contact. ESD has priority over all other applied local or remote control signals. Interlocks provide hardwired "permissive" protection (ie. main and bypass control) and are active for local and remote or may be configured for remote signals only.
Drive enable (option)	Positive switched 1x opto-isolated input. (maintain input)	20 - 60 VDC, 40 - 120 VAC	Maintain input configurable as drive enable: actuator will not operate unless signal is applied.

Options

120 VAC actuator derived supply	5 VA rated	Actuator derived supply for remote control.
125 VDC remote control	20 mA per input	Suitable for 125 VDC remote control supply - positive switching.
Negative switching	20 - 60 VDC	Suitable for negative switched systems applies to open, stop, close, ESD and interlocks.
Analogue control – Option Folomatic	0 to 5/10/20 mA or volt ranges	Proportional control over the whole or part of valve stroke. Configurable for open, close or stayput on loss of analogue signal.
Hydraulic shock 'water hammer'/ surge protection – Option Interrupter timer	Internal control system - Interrupter timer	Pulsed operation with independently adjustable on and off time periods in the range 1 - 99 seconds can be selected to operate over any portion of the closing or opening valve stroke, effectively reducing valve speed.

7.3 Remote Control & Indication cont.

Standard remote indication

Operation	Type	Range	Comments
Position, status and alarm indication	4 x configurable volt free latching contacts - S1 to S4. Single pole -single throw (SPST), configurable NO or NC	5 mA to 5 A[1], 120 VAC, 30 VDC	Independently configurable using the supplied Rotork Bluetooth® Setting Tool *Pro* to signal one of the following: **Valve position:** fully open, fully closed or intermediate positions (0-99% open) **Status:** Valve opening, closing, moving, local stop selected, local selected, remote selected, open or close interlock active, ESD active **Valve alarms:** Torque tripped in mid travel, going open, going closed, valve jammed, handwheel operation **Actuator alarms:** Lost phase (3-phase IQ only), customer 24 VDC (120 VAC) supply lost, battery low, internal failure detected, thermostat tripped, service alarms
Actuator availability / fault	Monitor relay configurable change over contact	5 mA to 5 A, 120 VAC, 30 VDC	In available mode the relay will de-energise when the actuator is unavailable for remote control due to any one or more of the following conditions: Power supply or control supply lost; local control selected; local stop selected; motor thermostat tripped; detected internal failure In fault mode, as above but ignores local/stop selection

Options

Operation	Type	Range	Comments
Position, status and alarm indication	Up to 8 configurable volt free latching contacts. Single pole – change over (SPCO)	5 mA to 5 A[1], 120 VAC, 30 VDC	Independently configurable using the supplied Rotork Bluetooth® Setting Tool *Pro* as per contacts S1 to S4 above
Analogue position feedback	Current position transmitter - CPT	4-20 mA output proportional to position	Auto range to set limits. Normally internally powered, available suitable for externally 'loop' powered - will default to 4 mA when actuator is powered down.
Analogue torque feedback	Current torque transmitter - CTT	4-20 mA output proportional to output torque	Range 0% to 120% of rated torque (4 to 20 mA)
Auxiliary power supply	Maintains power to the actuator control on loss of mains	Nominal 24 VDC, 1 A (switching inrush 8 A max)	Customer supply maintains backlit display, CPT analogue indication and bus network communications during actuator power outages. Customer supply is isolated from internal control power for protection

Reference documents:
Refer to PUB002-041 IQ Control and Monitoring.

Note:
1 Maximum total combined current through all four relays not to exceed 8 A.

7.4 Fieldbus System Control Options

IQ range actuators are available with the following network interface cards to enable remote control and indication using digital "bus" network systems communication to the Distributed Control Systems (DCS).

Standard remote controls

Network Type	Comments
Pakscan™	An internally mounted *Pakscan* field unit for remote control and status indication. *Pakscan Classic* network operates on a 2-wire current loop containing up to 240 field devices with a loop length of up to 20 km without repeaters and host communications using Modbus protocol. *Pakscan Wireless* operates over a secure wireless mesh network supporting up to 60 wireless actuators with 100 m between devices. Utilising the license free ISM frequency band (2.4 Ghz). Only compatible with existing *Pakscan* P3 wireless. For more information please refer to PUB059-048.
Modbus®	Modbus modules suitable for single or dual communication highways may be included in the IQ actuator, to provide Fieldbus communication of all the actuator control functions and feedback data. Data is carried on an RS485 data highway and the communications protocol used is Modbus RTU. System variables such as unit address and data baud rate are programmed over the Bluetooth data link. For more information please refer to PUB091-001.
Profibus®	A Profibus DP interface module is available to allow the actuator to be integrated into a Profibus network. Full compatibility with EN 50170 is provided and the Profibus network allows full actuator control and feedback of data to the host. For more information please refer to PUB088-001.
Foundation Fieldbus®	An IEC 61158-2 compliant Foundation interface module allows the actuator to be connected to a Foundation network. The device has link scheduler capability as well as digital and analogue function block capability. Foundation Fieldbus actuators can communicate directly between themselves without the need of a host supervisory system. For more information please refer to PUB089-001.
HART®	HART (Highway Addressable Remote Transducer) is a process control communication protocol. The signal consists of two parts, the analogue 4-20 mA current loop and a superimposed digital signal. Traditionally the 4-20 mA loop is used for control and the superimposed digital signal for feedback, diagnostics and configuration. Configuration and feedback using the HART digital signal can be achieved using the host connected to the actuator to select the parameters required. The majority of the user configurable settings can be made over the HART communication protocol. See PUB092-001 for further details.
DeviceNet®	DeviceNet® is a communications protocol which utilises the CAN bus network. The IQ DeviceNet® module Electronic Data Sheet (EDS) file is used to set up the actuator parameters and allow system performance to be optimised. Status, alarms and control functions are available over the DeviceNet® network. For more information please contact Rotork.

Standard Specifications

8 Protection and Operating Features

The IQ control system incorporates the following standard operating features and comprehensive valve, actuator and control protection to ensure reliable valve operation and protection under all circumstances.

Fault / Feature	Cause / Operation	Function
Obstructed valve	Valve meets an obstruction or process conditions that prevent movement. Obstruction must be sensed and operation prevented to prevent damage to valve and actuator.	**Independent Settable Open and Close Torque Switches** Torque switch will "torque trip" the actuator motor when the preset output torque level is reached. Torque switches can be set in the range 40% to 100% of rated torque. Torque trips are indicated on the actuator display and can be remotely signalled.
Jammed valve	Valve is stuck in its seat at the close or open position and operation fails to move the actuator and clear the limit position.	**Jammed Valve Protection** Torque switch will "torque trip" the actuator motor when the preset output torque level is reached or at 150% (nominal) if set to "bypass torque switch". Torque switches can be set in the range 40% to 100% of rated torque. Jammed valve protection prevents damage to valve and is indicated on the actuator display or remotely signalled.
Torque switch bypass	Provides increased torque above actuator rated for unseating sticky valves.	**Torque Switch By-pass** User selectable, torque switches are automatically bypassed during the first 5% of travel from both open and close limit positions. This permits torque up to 150% (nominal) of rated to be developed during unseating, ensuring "sticky" valves do not cause unwanted torque trips. Refer also to jammed valve protection, above.
Torque switch hammer	Actuator repeatedly tries to move an obstructed valve in response to a standing control signal. This can cause damage to both valve and actuator.	**Anti Hammer Protection** Once a torque trip occurs the control prevents repeated operation in the same direction as a response to a standing remote or local control signal. Actuator must be operated in the opposite direction and therefore moved away from the obstruction, which then has a chance to clear, before it can be signalled to run in the requested direction. Torque trips are indicated on the actuator display and can be remotely signalled.
Incorrect phase rotation (3-phase actuators only)	Due to 3-phase supply wiring incorrectly connected to actuator. Actuator moves in the opposite direction to that signalled. At end of travel the wrong limit/torque switch is activated preventing the motor being de-energised and causing it to stall with consequent valve damage and/or motor burn-out.	**Syncrophase™** Protection ensures actuator always runs in the correct direction corresponding to the applied control signal (open or close). The patented circuit senses connected phase rotation and ensures the actuator always runs in the correct direction by energising the appropriate motor control contactors/switches.
Lost phase / motor overheating (3-phase actuators only)	"Single phasing". One of the 3 phases applied to the actuator is lost due to fault causing the motor to single phase i.e. attempts to run with only 2 of the 3 phases applied. Motor may fail to start (stall) or run unbalanced causing overheating and possible burn-out.	**Syncrophase™** The patented circuit monitors all 3 supply phases. If a phase is lost the Syncrophase circuit prevents the motor from being energised. If during operation 1 phase is lost this cannot be detected due to back-feed through the motor windings, however once operation stops, re-energising of the motor will be prevented. Lost phase is indicated on the actuator display and can be remotely signalled.
Motor overheating	Actuator duty cycle is exceeded causing the motor to overheat. This often occurs during factory acceptance testing /commissioning or during process start up.	**Motor Thermostat Protection** Two thermostats are embedded in the motor end windings (hottest part of the motor) which directly sense motor temperature. Thermostats will open circuit when set temperature is reached causing the motor to be de-energised. Thermostats will auto-reset once the motor has cooled sufficiently allowing operation to continue. Motor thermostat trips are indicated on the actuator display and can be remotely signalled.

Standard Specifications

8 Protection and Operating Features cont.

Fault / Feature	Cause / Operation	Function
Instantaneous reversal	Control system instantaneously reverses the control signal which causes the actuator to reverse direction with associated inertial stress to valve drive and internal motor switching surges.	**Instantaneous Reversal Protection** A delay of 300 ms is automatically applied between reversals allowing the actuator to come to rest before responding to reverse control signal.
Actuator fault	Detected actuator fault.	**ASTD (Automatic Self Test & Diagnosis)** ASTD detects any internal control system failures preventing operation. Detected internal control system faults are indicated on the actuator display allowing rapid diagnosis and can be remotely signalled. In addition diagnostic screens can be accessed allowing problem to be pin-pointed.
Remote control circuit failure (actuator derived remote control supply only)	Loss of remote control.	**Remote Control Supply** The 24 VDC internal power supply made available for remote control switching is protected by an auto-reset fuse device. Should the power drawn from the supply exceed its rating (due to a remote control wiring fault, etc.), the fuse will disconnect the supply. Once the fault is cleared the supply will automatically be reinstated. Loss of internal supply is indicated on the actuator display and can be remotely signalled.
Spurious operation	Operation commanded due to unintended or spurious remote control signals leading to process problems or hazards.	**Conditional Control** User selectable. The interlock input can be configured for "conditional control", being active only for remote control. In this mode, for the actuator to respond to a remote control signal, two signals must be applied simultaneously, one to the control input and one to the interlock input. If an unintended or spurious signal is applied only to the control input it will be ignored. Intended signals can therefore be verified by applying a second "permissive" signal, effectively preventing spurious operation.
Emergency Shutdown (ESD)	Priority action where the valve is required to stayput or move to a safe end-of-travel position determined by the process - open or closed limit.	**Dedicated ESD Control Input** User configurable, the ESD action has priority over any existing or applied local or remote control signal. ESD can be configured to open, close or stayput depending on the process requirements. ESD must be derived from a latched type, normally open or normally close ESD contact (configurable) and may be configured to override local stop, interlocks or interrupter timer.

Standard Specifications

9 Components

Details of major actuator mechanical and electrical/electronic components are provided below:

9.1 Handwheel

A handwheel is provided to allow manual operation of the valve during electrical power interruption. Handwheel size and mechanical advantage are generally designed in accordance with standards EN 12570 and AWWA C540 (American Water Works Association) to give the most efficient compromise of force and turns for emergency operation.

Handwheel types: IQ, IQS, IQD, IQM, IQML, IQL

Actuator size	Standard Type / Ratio	Option
10, 12, 18	Direct / 1:1	Geared / 5:1
19, 20	Direct / 1:1	Geared / 13.3:1
25	Geared / 13.3:1[1]	Direct / 1:1[2]
35	Geared / 22.25:1	✗
40	Geared / 15:1	Geared / 30:1
70, 90, 91	Geared / 30:1	Geared / 45:1
95	Geared / 45:1	Geared / 30:1[2]

Note:
1 IQM25 and IQML25 standard ratio is 1:1.
2 Rimpull does not meet the requirements of EN12570 at actuator rated torque. May be used for lower torque applications or where higher handwheel forces are acceptable.

Handwheel types: IQT

Actuator	IQTF50	IQTF100	IQT125 IQTF125 IQTM125	IQT250 IQTF250 IQTM250	IQT500 IQTF500 IQTM500	IQT1000 IQTF1000 IQTM1000	IQT2000 IQTF2000 IQTM2000	IQT3000 IQTF3000 IQTM3000
Turns for 90°	26	26	88	88	88	83	83	83

During electric operation of the actuator, the handwheel is mechanically disengaged from the drive. To engage handwheel operation, the hand/auto selection lever is pushed down and released after which handwheel operation remains selected. When electrical operation takes place the actuator will automatically return to motor drive without lever or handwheel kickback.

The hand/auto selection lever incorporates a facility for locking in the hand or auto positions using a 6 mm diameter hasp padlock (not supplied by Rotork), preventing engagement of motor drive (locked in hand) or engagement of handwheel drive (locked in auto). Emergency disengagement of motor drive can be selected by pushing down and holding the hand/auto lever during electric operation.

Standard Specifications

9.2 Drive Train

The drive train and motor uses the proven basic design principals employed for over 50 years. Simple, reliable and robust, the components are oil bath lubricated (for life).

IQ actuators are factory filled for life with premium quality gear oil selected for the application. Standard oils are automotive grades easily available worldwide and have been used successfully for over 50 years. Oil lubrication out-performs grease over a wide temperature range and allows installation in any orientation. It has none of the problems associated with grease such as separation at elevated temperatures and "tunnelling" at lower temperatures where grease is thrown away from rotating components creating a void or tunnel in the grease around components that require lubrication.

Lubrication

Range	Standard Temperature Range -30 to +70 °C (-22 to +158 °F)	Option Low Temperature -50 to +70 °C (-58 to +158 °F)	Option Food Grade -20 to +70 °C (-4 to +158 °F)
IQ	SAE80EP	MOBIL SHC624	Hydra Lube GB Heavy

	Standard Temperature Range -50 to +70 °C (-58 to +158 °F)	Option Food Grade -20 to +70 °C (-4 to +158 °F)
IQT 50 - 500	600 ml made up from TEXACO ATX / Dexron2 (120 ml), CASTROL Aero HF585B (480 ml)	Hydra Lube GB Medium
IQT 1000 - 3000	1600 ml made up from TEXACO ATX / Dexron2 (320 ml), CASTROL Aero HF585B (1,280 ml)	Hydra Lube GB Medium

Food grade
Lubricant is a synthetic, non-aromatic hydrocarbon mixture with PTFE and other additives. It does not contain chlorinated solvents.
Food grade grease used in assembly and thrust bearings is Hydra Lube WIG Medium-NLGI-123.

9.3 Corrosion Protection

All IQ actuator finishes are tested in accordance with Rotork 1,000 hour cyclic salt spray test procedure which is the most realistic and arduous test cycle applicable. The test combines cyclic salt spray, drying and humidity at elevated temperatures on complete factory built actuators. This tests the finish and the various substrate materials, fixings and interfaces that make up an actuator. Substrate materials and finishes are selected to provide maximum corrosion resistance combined with good adhesion. Paint finishes fully conform to the requirements of ISO12944. Fireproofing options available:

- System ER
- K-Mass
- FR coating by Mov

Corrosivity category	IQ paint solution	Exterior environment	Interior environment
C1	Standard Polyester powder coat (P1)	N/A	Heated buildings with clean atmospheres e.g. offices, shops, schools and hotels.
C2		Atmospheres with low levels of pollution, e.g. rural areas.	Unheated buildings where condensation may occur, e.g. depots and sports halls.
C3		Urban and industrial atmospheres, moderate SO2 pollution, e.g. city centres and coastal areas with low salinity.	Production rooms with high humidity and some air pollution, e.g. food processing plants, laundries, breweries and dairies.
C4	Standard Polyester powder coat plus offshore coating on ferrous materials (P2)	Industrial and coastal areas with moderate salinity, e.g. coastal ship and boatyards.	Areas with permanently aggressive atmospheres, e.g. chemical plants and swimming pools.
C5-M (Marine)		Coastal and offshore areas with high salinity, e.g. offshore rigs and boats.	Areas with extremely aggressive atmospheres containing high humidity, salinity and pollutant concentration, e.g. cooling towers and boats.
C5-I (Industrial)	Full offshore coating on all materials (PX)	Industrial areas with high humidity and aggressive atmospheres, e.g. water treatment plants and power stations.	Areas with extremely aggressive atmospheres containing high humidity and high pollutants, e.g. chemical plants and boiler houses.

The above table details paint protection levels based on high durability (>15 years) as per ISO12944-2.

Standard Specifications

9.4 Motor

IQ actuators utilise purpose designed motors that are integral to the actuator. As such, these motors do not fall within the scope of IEC 60034 or MG1, however they do meet the applicable requirements, where appropriate, of motor design for actuator operation.

Actuator Type	Duty Classification	Comments
IQ	On-Off & Inching (Class A & B)	Class F insulated, 3-phase squirrel cage motor incorporating thermostat protection. Low inertia design. Class H available as an option where hazardous area certification does not limit temperature rise to "T4" 135 °C.
IQS	On-Off & Inching (Class A & B)	Class F insulated, 1-phase capacitor / run start squirrel cage motor incorporating thermostat protection. Low inertia design. Class H available as an option where hazardous area certification does not limit temperature rise to "T4" 135 °C.
IQD	On-Off & Inching (Class A & B)	Class F insulated, permanent magnet DC brush motor incorporating thermostat protection.
IQM	Modulating (Class C)	Class F insulated, 3-phase squirrel cage motor incorporating thermostat protection. User selectable thyristor controlled dynamic braking available. Low inertia design. Class H available as an option where hazardous area certification does not limit temperature rise to "T4" 135 °C.
IQT[1]	On-Off & Inching	Class H insulated, permanent magnet 24 VDC motor[2] (DC supply derived internally from 3-phase and 1-phase supplies) incorporating thermostat protection. Low inertia design.
IQTM[1] **/ IQTF**[1]	Modulating	Class H insulated, permanent magnet 24 VDC motor (DC supply derived internally from 3-phase and 1-phase supplies) incorporating thermostat protection. Low inertia design.

Note:

1 Speed control independent of load, temperature and supply voltage.
Speed is automatically reduced on fast operating units to reduce inertial impact when running into an end stop (5% from user set position limit).
Speed is automatically adjusted when positioning the actuator via analogue or network control to improve positional accuracy.

2 IQT3000 uses a 36 VDC permanent magnet motor.

Standard Specifications

9.5 Power Module

The power module for IQ actuators produces internal power supplies for control systems and remote control derived from the actuator electrical supply. It also contains the motor control and switching components.

Actuator Type	Internal Power Supplies	Motor Switching
IQ	Split bobbin transformer producing control circuits, option card supplies and supply for 24 VDC actuator fed remote control (120 VAC option).	Reversing contactor assembly, mechanically and electrically interlocked. 24 VDC coil up to and including size IQ35 and 120 VAC for IQ40 and above.
IQD	DC-DC converter isolates the DC actuator supply from internal supplies for control and 24 VDC supply for actuator fed remote control. Fuse protected. Incorporates sleep circuit for power reduction when used on solar powered derived DC supplies.	Reversing contactor assembly, mechanically and electrically interlocked.
IQS	Split bobbin transformer producing control circuits, option card supplies and supply for 24 VDC actuator fed remote control (120 VAC option). Fuse protected.	Solid state thyristor array for motor switching/ reversal and capacitor starting. Includes snubber protection and timing control.
IQM	Split bobbin transformer producing control circuits, option card supplies and supply for 24 VDC actuator fed remote control. Fuse protected.	Solid state thyristor array for motor switching/ reversal and braking (user selectable). Includes snubber protection and timing control.
IQT / IQTF / IQTM	Split bobbin transformer producing control circuits, option card supplies and supply for 24 VDC actuator fed remote control (120 VAC option). Fuse protected.	Solid state motor switching incorporating motor speed control.
IQT / IQTF / IQTM 24 VDC actuator power supply only	DC-DC converter isolates the DC actuator supply from internal supplies for control and 24 VDC supply for actuator fed remote control. Fuse protected.	Rectifier and fuse protection ensures correct polarity and protection of supply. Solid state motor switching incorporating motor speed control.

9.6 Torque Sensor

State of the art piezo thrust sensor measures motor shaft thrust produced as a reaction to output torque developed in the motor worm and wheel gear assembly. Thrust measured is directly proportional to output torque. The piezo sensor develops a voltage proportional to shaft thrust (output torque) which is amplified and then measured by the control module. Output torque is controlled by switching the motor off when the set torque limits have been reached. This system allows the torque to be displayed via the LCD display and captured by the data logger in the form of valve torque profiles, statistical torque information and the event log.

9.7 Position Sensor

Using the latest technology and after years of testing, the patented Rotork IQ absolute encoder is contactless, has only four active parts, can measure up to 8,000 output turns with a resolution of 7.5° and has redundancy and self checking. Unlike existing absolute encoder designs, this technological breakthrough increases position sensing reliability while providing zero-power position measurement.

9.7.1 Mechanical Position Indication

The availability of the graphical display, even on power loss, usually supercedes the need for mechanical position indication, however a mechanical position indication option is available upon request.

9.8 Control and User Interface (UI) Modules

The control and UI modules for IQ actuators are common and take the form of a PCB with on-board liquid crystal displays (LCD) and a control PCB. For IQM actuators the control module incorporates "fast remote" mode (24 VDC remote control only) allowing rapid actuator switching down to 100 ms pulses for precise positioning.

Logic controlled, the control module is programmed over the non-intrusive Bluetooth interface with set-up configuration for torque, limits indication and control features undertaken using the Rotork Bluetooth® Setting Tool *Pro*. It monitors local and remote control signals, torque and position to switch the actuator motor in the correct direction or off.

Standard IQ control features are shown below:

Feature	Type	Specification
Remote control	Input	User switched Open/Close/Stop/ESD and interlock signals. Opto-isolated inputs for protection.
Local control	Input	Open/Close/Stop and Local/Remote selection. Non-intrusive control switches are magnetically operated so there is no penetration of covers.
Position	Input	Digital signal derived by absolute position sensor. Resolution to 7.5° of output rotation. Limit range configurable between 2.5 and 8,000 output turns.
Torque	Input	The piezo thrust sensor directly measures output torque and converts value to a voltage signal. Torque can be set in the range 40% to 100% of rated torque with the additional facility to bypass torque switching.
Set-up	Input	Set-up over the Bluetooth interface allows all settings to be configured for valve and process requirements. Set-up is non-intrusive requiring no covers be removed using the supplied Rotork Bluetooth® Setting Tool *Pro*. All settings can be password protected.
Indication contacts	Output	Four Volt free contacts S1 to S4 can be configured for a variety of position, status and alarm indication for remote indication and monitoring.
LCD indication	Output	The onboard backlit LCD display presents position, torque and setup displays for configuration. The LCD display is divided into two parts providing a large position indication (Open/Close icons plus % readout in 0.1% increments for mid travel) and a multilingual text display providing status, alarm and set up information.
Data logger	Output	The control module includes a data logger which stores torque, position and operational data in non-volatile memory for download via Bluetooth to the supplied Rotork Bluetooth® Setting Tool *Pro* or notebook PC. Data is date/time stamped. Data logger can be analysed using freeware Insight 2 for PC.
Memory	System	All configured settings are stored in non-volatile EEPROM memory (does not require power).
Micro-controller	System	Provides all control function logic, setup programming and allied system requirements. Software is field upgradeable for future enhancements. The micro-controller is widely used in the automotive industry with a long track record and a very reliable history.

Standard Specifications

9.9 Conduit / Cable Entries

IQ gearcases are machined with conduit/cable entries as indicated below. Alternative adapters are available.

Number of entries required and adapter type must be specified with order.

Actuator type	Gearcase Entries	Adapter 1	Adapter 2
IQ, IQM, IQS, IQD	3 x M25 plus 1 x M40	3 x 1" plus 1 x 1.5" ASA NPT	3 x PG16 plus 1 x PG29
IQT, IQTM, IQTF	4 x M25	4 x ASA NPT 0.75"	4 x PG16

IQ range actuators are despatched with transit plugs fitted into the conduit entries. It is the responsibility of the installer to ensure the appropriate cable/conduit adapters, cable glands and/or blanking plugs are fitted in order to maintain hazardous area certification and ingress protection levels. Certified adapters and blanking plugs are available as optional extras.

9.10 Terminals

The terminal compartment for IQ range actuators takes the form of a separately sealed compartment containing segregated metric thread M5 power and M4 control terminals. Terminal screws and washers are supplied with the actuator. Terminals are designed to accept ring tag crimped field wiring conductors up to 16 mm^2 for power and 4 mm^2 for control/indication. The terminal compartment cover carries a terminal identification code card. Each actuator is despatched with the applicable Installation and Maintenance Manual, actuator wiring diagram and remote control connection schematic.

9.11 Wiring

IQ range actuators utilise jig built wiring harnesses of individually numbered, tropical grade PVC insulated, stranded conductors. All internal control connections to the printed circuit boards use unique or polarised plugs and sockets.

9.12 Battery

The battery provides power to support the LCD display and remote (relay) indication when the main actuator supply is unavailable. The battery also provides power to enable actuator settings to be made using the Rotork Bluetooth® Setting Tool *Pro*; commissioning can take place at premises without power or the right voltage, or after installation but before site cabling is completed.

The standard 9 V battery is available worldwide with a high/low temperature type available from Rotork.

As all settings are stored in non-volatile memory and position is sensed by the Rotork absolute encoder, security of configuration and position is always assured. The actuator can be operated perfectly well electrically and by handwheel operation without a battery fitted.

Based on experience gained over 20 years of typical applications, the expected battery life is up to five years.

Battery life is however subject to temperature and at elevated and reduced temperatures may be reduced. Actuator indicates battery status locally and in remote.

9.13 SIL Capability

Actuators for use within a Safety Instrumented System (SIS) are available with the relevant Safety Integrity Level (SIL) certification. Both IQ and IQT can be supplied with the optional SIL stayput mode enabled which uses the Motor Enable feature to prevent unwanted operation from spurious signals. In addition the IQ can be supplied with the "Move to Limit" SIL2/3 option to either open or close in an emergency. For full details please refer to the SIL brochure PUB002-104.

Site Services

Rotork understand the value of prompt, punctual and superior site services. Rotork Site Services have specialist expertise, insight and experience in service support for mission-critical flow control and instrumentation solutions for oil and gas, water and wastewater, power, chemical process and industrial applications. We offer global frontline support backed by dedicated in- house experts.

Our service solutions increase plant efficiency and reduce maintenance costs, while workshop services return equipment to as-new condition. Our experience and understanding of the flow control industry means we have extensive insight and ideas of what we can do to provide significant value to our customers and their operations.

Rotork Site Services is comprised of two main areas; Lifetime Management and Site Services. Lifetime Management is the suite of services within Rotork Site Services which help you manage the risk associated with aging assets and includes our Reliability Services offering. Site Services comprises essential actuator service, repair, maintenance and upgrades.

Rotork has specialist expertise, insight and experience in flow control.

We provide insight into how we can deliver value to our customers.

Our service solutions increase plant efficiency and reduce maintenance costs.

Site Services

Lifetime Management

The services available within Lifetime Management offer a complete solution to managing the risks associated with the life cycle of your equipment and their obsolescence (which compromise reliable performance and valuable uptime).

The aim of Lifetime Management is to provide you with constant support and minimum- to- no disruption to your production flow. It is a customisable service offering designed to seamlessly maintain and improve your assets. We manage the inherent risks associated with advances in technology, component obsolescence and ageing equipment for you. We are committed to helping customers maximise the continuous, fault-free operation and working life of their actuators. Supporting the continuous and reliable operation of your plant allows for improved performance and increases in valuable uptime.

Lifetime Management covers:

- Reliability Services
  - Health Check
  - Planned Maintenance
  - Enhanced Warranty
  - Predictive Maintenance
- Upgrade Services (retrofit)
- Planned Shutdown Support (service or run time)
- Life Cycle Services (based on years in service or run time)
- Overhauls/Refurbishment
- Customised Spares Programme
- Training
- Consultancy

Site Services

Rotork's Site Services comprises the essential on-site actuator service, repair, maintenance and upgrades part of our service offering, plus the commissioning of new actuators and applications. It includes off-site work completed at a Rotork Support Centre including recertification, automation, testing and product selection.

Our decades of experience in the industrial actuation and flow control markets means that customers can rely on us to understand their problems and to deliver reliable, economic solutions. Rotork's talented and experienced engineers have an in-depth understanding of the problems that are faced in the field and they know how to fix them.

On sites where providing evidence of valid asset certification is a legal requirement, Rotork engineers can carry out the necessary OEM level inspections and provide the statutory paperwork to comply with regulations.

- Planned Shutdown Support
- Actuator Workshop Overhaul
- Field Support
- Valve Automation Services
  - On-site
  - Off-site
- Global Support

rotork®

www.**rotork**.com

A full listing of our worldwide sales and service network is available on our website.

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PUB002-038-00
Issue 01/21

rotork®

Remote Hand Station

Remote field operation for IQ and SI 3rd generation actuators

Actuators used in many industries sometimes have to be mounted in places where it is hazardous, inconvenient or just unpleasant for a human to operate. In these cases it is useful to be able to see the status and locally operate an actuator from a safe distance.

Typically in this situation you would be faced with a simplistic interface for basic operation and indication, however Rotork's superior solution matches the comprehensive, feature rich interface provided with IQ and SI 3rd generation range actuators.

Remote Hand Station (RHS) enables remote configuration, interrogation and operation of the connected actuator up to 100m from the valve installation. Configuration with a Rotork *Bluetooth*® Setting Tool Pro maintains the familiar user friendly experience associated with IQ and SI range actuators.

Configuration and data log information can be viewed and extracted locally from the RHS instead of gaining access to the actuator. Power for the RHS is supplied by the actuator, avoiding the need for supplementary power supplies.

Features and Benefits

- Installation using standard data cable, up to 100 metres away from the actuator
- Pole or wall mountable
- Replica of the actuator user interface, including setup and configuration
- Powered via the attached actuator (24 VDC output)
- Explosionproof option available
- Enclosure IP66 / IP68 (7 m for 72 Hours)
- Double-sealed
- Simple installation
- Asset management and data log information available to view or extract locally

RHS operating IQ and SI actuators in inaccessible locations

rotork®

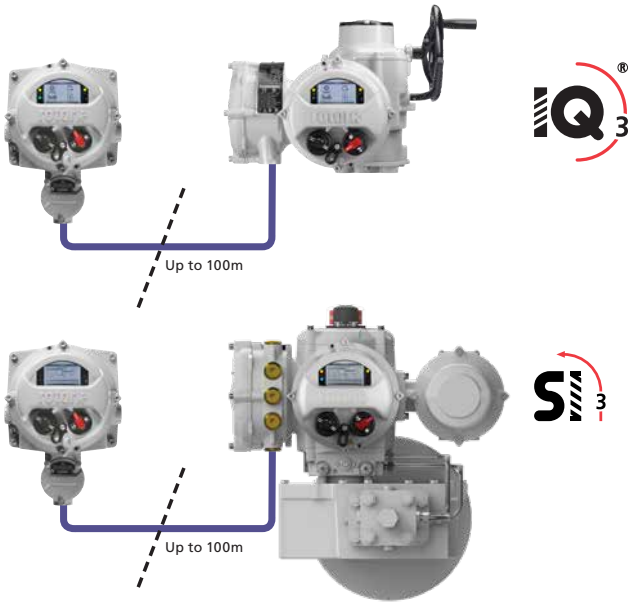
Keeping the World Flowing

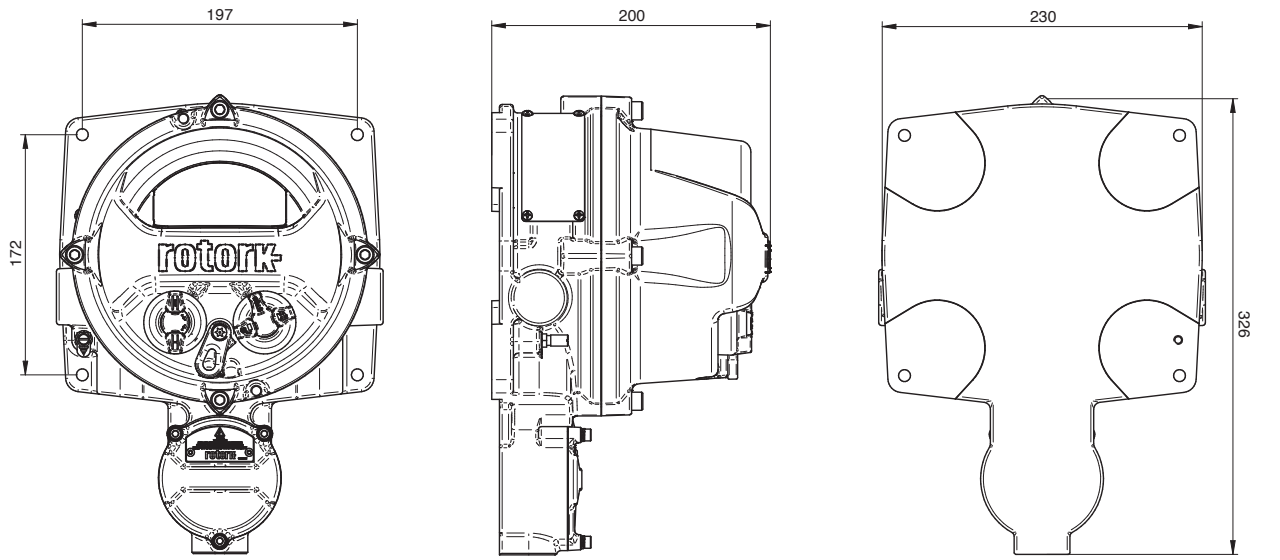
Remote Hand Station

Remote field operation for IQ and SI 3rd generation actuators

Specification

Type	Standard	Optional
Enclosure Non-Hazardous	IP66 / IP68 (7 m / 72 hours), NEMA 4, 4X & 6, Double-sealed	–
Enclosure Hazardous	ATEX, CSA, CSAus and IEC	–
Temperature Range	-30 to +70 °C (-22 to +158 °F)	-50 °C (-58 °F)
Power Supply	Actuator derived 24 VDC	–
Mounting Options	Wall or pole mounted	–
Coating	Polyester powder coated	Off-shore paint, special colours
Support Tools	Rotork *Bluetooth*® Setting Tool Pro, Insight2	–
Local Control	Non-Intrusive, Local/Stop/Remote (lockable) selector and Open/Close selectors	Vandal-proof cover





Drawing dimensions in millimetres

A full listing of the Rotork sales and service network is available on our website.

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email mail@rotork.com

Controls
Electric Actuators and Control Systems

Fluid Systems
Fluid Power Actuators and Control Systems

Gears
Gearboxes and Gear Operators

Instruments
Precision Control and Indication

Site Services
Projects, Services and Retrofit

PUB002-056-00
Issue 06/18

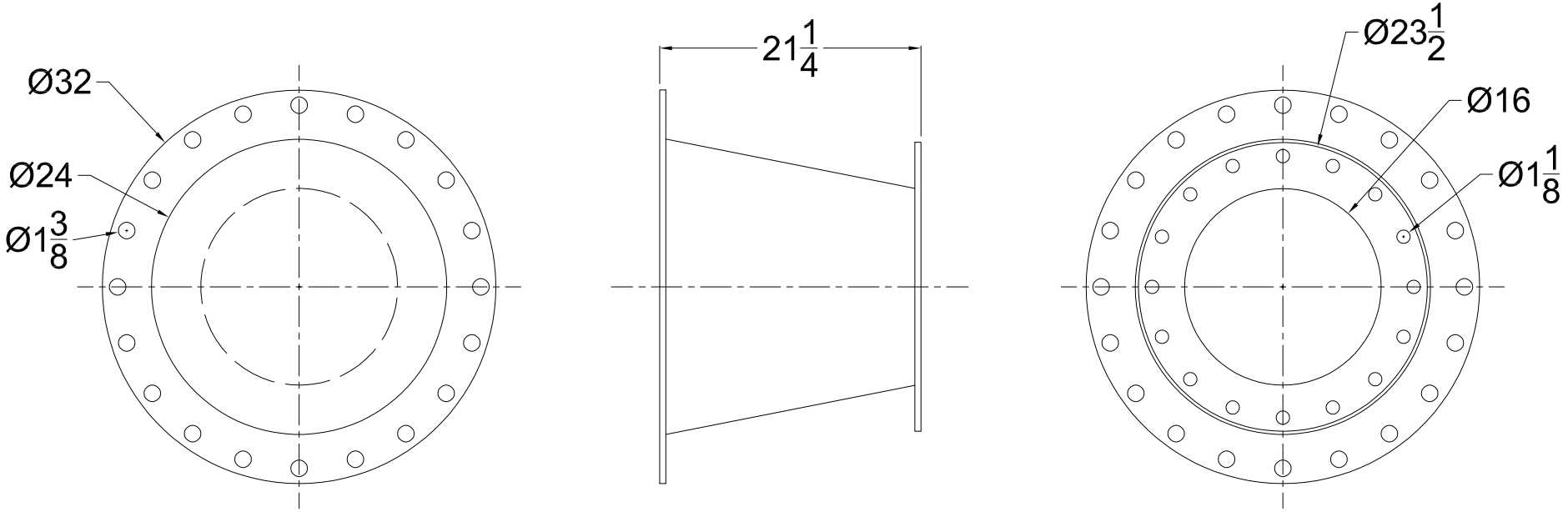
SECTION 4.8

INLET SPOOL PIECE

Lone Star Blower
8883 West Monroe
Houston, TX 77061

PH: 832-532-3112
FAX: 832-532-3115

REVISION HISTORY			
REV	DESCRIPTION	DATE	APPROVED



NOTES:

1) INLET SPOOL PIECE REQUIRES PIPE SUPPORTS.

THIRD ANGLE PROJECTION

DRAWING IS FOR REFERENCE ONLY UNLESS SPECIFIED AS RELEASED.

APPROVALS		
DRAWN	ADW	03/04/2021
CHECK		
ENGINEER		
MANUFACTURING		
CONTROL		
APPROVED		

LONE STAR BLOWER

TITLE
16" TO 24" INLET SPOOL PIECE
LS24-5

SIZE	CAGE CODE	DWG NUMBER	REV
A	-	S20-12175-INSPOOL	0
SCALE		SHEET 1 OF 1	

SECTION 4.9

DISCHARGE EXPANSION JOINT

Lone Star Blower
8883 West Monroe
Houston, TX 77061

PH: 832-532-3112
FAX: 832-532-3115

Maxi-Joint®

Single (1) Wide Arch Expansion Joints

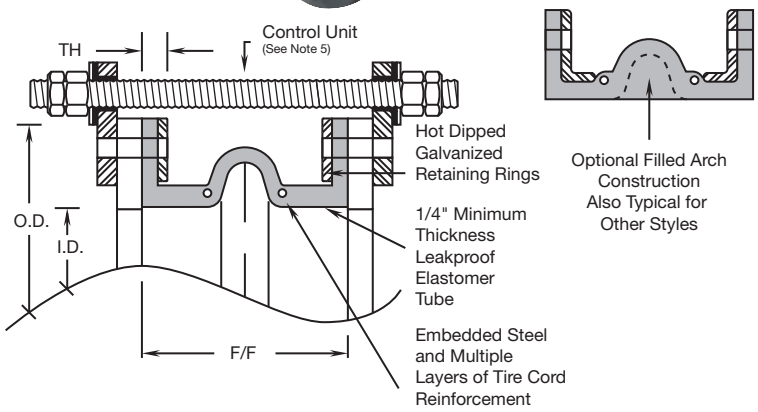
Style 1101

Features:

- Versatile hand-built construction. Made in the U.S.A.
- Standard or custom face to face dimensions
- Wide flowing arch design
- Exceptional all directional movement capability
- Virtually eliminates sediment buildup
- Higher pressure rating than conventional expansion joints
- Excellent chemical and abrasion resistance
- Full vacuum rating (30" Hg) in all sizes
- 250ºF continuous service standard, 400ºF available
- Filled arch design available
- Hot dip galvanized retaining rings standard
- Absorbs noise, vibration and shock
- Compensates for minor misalignment and offset
- Low stiffness and deflection forces
- Integrally flanged design, no gaskets required
- Simple to install and high strength
- Provides easy access to piping and equipment
- Other standard drilling available, including ASA 300, DIN, PN, JIS, API, and Navy
- Wide variety of tube and cover elastomers available, including Pure Gum Rubber, EPDM, Neoprene, Butyl, Nitrile, Hypalon®, Viton®, Teflon®, Food Grade, and more

Photo of narrow arch joint shown.

Style 1101
Single (1) Wide Arch,
Spool Type, Expansion Joints



SIZE	LENGTH	MAX	VACUUM	FLANGES – 125/150 LB. (NOTE 8)					MOVEMENTS					SPRING RATE			GROSS
I.D. (inch)	F/F (inch)	Pressure (PSIG)	Rating (inch Hg)	O.D. (inch)	B.C. (inch)	Hole (no.)	Hole (inch)	TH. (inch)	Comp. (inch)	Ext. (inch)	Lateral (inch)	Angular (degree)	Torsional (degree)	Comp. (lbs/in)	Ext. (lbs/in)	Lateral (lbs/in)	Weight (lbs)
2	6	220	30	6	4-3/4	4	3/4	7/8	1 3/4	7/8	1	39	4	270	340	450	7
2-1/2	6	220	30	7	5-1/2	4	3/4	7/8	1 3/4	7/8	1	33	3.8	340	420	480	8
3	6	220	30	7-1/2	6	4	3/4	7/8	1 3/4	7/8	1	28	3.7	400	510	540	10
4	6	220	30	9	7-1/2	8	3/4	7/8	1 3/4	7/8	1	22	3.6	550	710	590	14
5	6	220	30	10	8-1/2	8	7/8	7/8	1 3/4	7/8	1	18	3.4	670	880	710	17
6	6	220	30	11	9-1/2	8	7/8	7/8	1 3/4	7/8	1	15	3.2	820	1050	790	20
8	6	220	30	13-1/2	11-3/4	8	7/8	7/8	1 3/4	7/8	1	12	3.1	990	1160	960	29
10	8	220	30	16	14-1/4	12	1	7/8	2	1	1 1/4	17	3	960	1170	820	39
12	8	220	30	19	17	12	1	7/8	2	1	1 1/4	14	2.9	1,010	1,250	970	58
14	8	220	30	21	18-3/4	12	1-1/8	1	2 1/4	1 1/8	1 1/4	12	2.8	1,080	1,300	1,140	65
16	8	160	30	23-1/2	21-1/4	16	1-1/8	1	2 1/4	1 1/8	1 1/4	11	2.7	1,150	1,390	1,320	80
18	8	160	30	25	22-3/4	16	1-1/4	1	2 1/4	1 1/8	1 1/4	10	2.6	1,220	1,570	1,450	90
20	8	130	30	27-1/2	25	20	1-1/4	1	2 1/4	1 1/8	1 1/4	9	2.5	1,280	1,750	1,620	101
24	10	130	30	32	29-1/2	20	1-3/8	1 1/8	2 1/2	1 1/4	1 3/8	8	2.4	1,730	2,100	1,740	120
30	10	100	30	38-3/4	36	28	1-3/8	1 1/8	2 1/2	1 1/4	1 3/8	7	2.3	2,180	2,660	2,190	172
36	10	90	30	46	42-3/4	32	1-5/8	1 1/8	2 1/2	1 1/4	1 3/8	6	2.2	2,660	3,250	2,680	219
42	12	90	30	53	49-1/2	36	1-5/8	1 1/8	2 1/2	1 1/4	1 1/2	4.8	2.1	3,030	3,650	3,020	290
48	12	90	30	59-1/2	56	44	1-5/8	1 1/8	2 1/2	1 1/4	1 1/2	4.2	2	3,390	4,150	3,410	342
54	12	85	30	66-1/4	62-3/4	44	2	1 1/8	2 1/2	1 1/4	1 1/2	3.8	1.9	4,120	5,020	4,140	405
60	12	85	30	73	69-1/4	52	2	1 1/8	2 1/2	1 1/4	1 1/2	3.6	1.8	4,520	5,560	4,580	500
66	12	85	30	80	76	52	2	1 1/8	2 1/2	1 1/4	1 1/2	3.3	1.7	5,250	6,390	5,270	580
72	12	85	30	86-1/2	82-1/2	60	2	1 1/4	2 1/2	1 1/4	1 1/2	3	1.6	5,900	7,180	5,920	650
78	12	80	30	93	89	64	2-1/8	1 1/4	2 1/2	1 1/4	1 1/2	2.6	1.5	6,420	7,850	6,570	715
84	12	80	30	99-3/4	95-1/2	64	2-1/4	1 1/4	2 1/2	1 1/4	1 1/2	2.3	1.4	6,950	8,670	7,400	780
90	12	80	30	106-1/2	102	68	2-3/8	1 1/4	2 1/2	1 1/4	1 1/2	2.1	1.3	7,270	9,200	8,080	880
96	12	80	30	113-1/4	108-1/2	68	2-1/2	1 1/4	2 1/2	1 1/4	1 1/2	2	1.2	7,650	10,100	9,070	1,010
102	12	60	30	120	114-1/2	72	2-5/8	1 3/8	2 1/2	1 1/4	1 1/2	1.6	0.8	8,128	10,730	9,640	1,073
108	12	60	30	126-3/4	120-3/4	72	2-5/8	1 3/8	2 1/2	1 1/4	1 1/2	1.5	0.7	8,606	11,360	10,200	1,136

Notes:

1.) All parts listed are designed for 30" Hg (full vacuum) and have a maximum test at 26" Hg due to facility altitude and equipment limitations.

2.) Maximum operating temperature of 250 deg F for EPDM, Butyl, Hypalon, and Viton; 225 deg F for Neoprene; 210 deg F for Nitrile; 180 deg F for Pure Gum Rubber; 300 deg F for EPDM and Butyl in air service at 25 PSI maximum; higher pressure and temperature ratings available.

3.) All sizes can be supplied with a filled arch reducing their movements by 50% and increasing the spring rates fourfold.

4.) For full product specifications and installation instructions, see SPEC 1101-1 and ININ 1101-1. Gross weights include retaining rings.

5.) **WARNING:** Control units (sold separately) must be used when piping is not properly anchored. Number of rods are dependent upon maximum field test pressures. Expansion joints may operate in pipelines carrying fluids at elevated temperatures and pressures, so precaution should be taken to ensure proper installation and regular inspection. Care is required to protect personnel in the event of leakage or splash. Adequate floor drains are always recommended.

6.) Movements are non-concurrent. Contact General Rubber for concurrent movements, and for sizes not shown up to 144" I.D.

7.) Series 1100 and 1200 replace styles 1025, 1050 and 1075.

8.) Standard 125/150 lb. drilling includes, 1"-24" with ANSI B16.1 Class 125 lb./B16.5 Class 150 lb., 30"-60" with ANSI B16.1 Class 125 lb./ B16.47 series A, Class 150 lb., 72"- 108" with ANSI B16.1 Class 125 lb./ AWWA C207 Class B.

Toll Free: 800-233-6294
Web: www.general-rubber.com

general rubber corporation

Fax: 201-935-1915
sales@general-rubber.com

SECTION 4.10

DISCHARGE ISOLATION VALVE

Lone Star Blower
8883 West Monroe
Houston, TX 77061

PH: 832-532-3112
FAX: 832-532-3115

RESILIENT SEATED

BUTTERFLY VALVES

Bray®

BRAY.COM

THE HIGH PERFORMANCE COMPANY

ISOLATION FROM LINE MEDIA

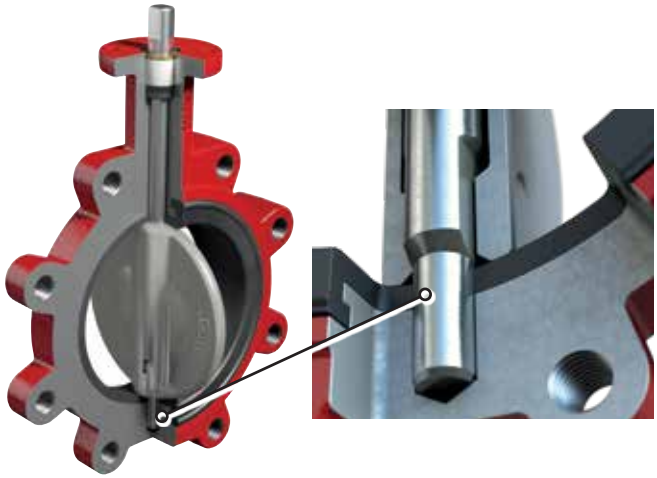
Bray's seat design and internal disc to stem connection isolates the line media from the body and stem.

INTERNAL DISC TO STEM CONNECTION

Series 30/31 Sizes 2"– 20" (50mm–500mm)

Bray offers Double "D" precision machined flats on the stem and in the disc. The Series 30/31 internal, non-wetted connections eliminate exposed external disc to stem connections.

The disc and the stem connection minimizes hysteresis and produces maximum strength engagements. All stem designs incorporate a blowout proof feature.



SEAT DESIGN

The seat is designed to seal with slip-on or weld-neck flanges and the molded o-ring eliminates the need for flange gaskets. The tongue and groove locks the seat in place and makes the valve dead end capable.

Tongue and Groove

POLYESTER COATING

The Bray standard polyester body coating is a hard, gloss red finish. The polyester coating provides excellent corrosion and wear resistance.

Chemical Resistant

Resistant to dilute acids and alkalies, petroleum solvents, alcohols, greases and oils.

Weatherability

Resistant to humidity, water and ultraviolet radiation.

Abrasion and Impact Resistant

NYLON 11 COATING

Nylon 11 has superior corrosion resistance and has been used successfully in many applications such as water, cement, food and seawater.

Weatherability

Bray's Nylon 11 coating has been salt spray tested in excess of 2000 hours and used in seawater immersion service for over 30 years without any deterioration of the coating resulting in no corrosion to the coated metal components.

Abrasion and Impact Resistant

SEACORR® COATING

This proprietary coating for actuators provides superior product protection in corrosive conditions, tested to ASTM B-117.

Other customer specified coating materials are available. Please consult your local Bray representative for your specific application.

All Bray valves are pressure tested to 110% of rated pressure to assure bubble tight shutoff.

The Bray Series 30/31 features a high strength one piece stem design utilizing an efficient internal disc to stem connection. This resilient seated butterfly valve provides a primary and secondary seal between the disc and seat as well as the stem and seat which ensures the total encapsulation of the line media and zero external leakage.

PRESSURE RATINGS

BIDIRECTIONAL BUBBLE TIGHT SHUT OFF – Standard Disc* Downstream flanges and disc in closed position		
Series 30/31 Standard Disc*	2"-12" (50-300mm)	175 psi (12 bar)
	14"-20" (350-500mm)	150 psi (10.3 bar)
DEAD END SERVICE – Lug Bodies and Standard Disc* No downstream flanges and disc in closed position		
Series 31	2"-12" (50-300mm)	75 psi (5.2 bar)
	14"-20" (350-500mm)	50 psi (3.4 bar)
BODY: 250 psi (17.2 bar) CWP		

*For low pressure (50 psi) applications, Bray offers a standard reduced disc diameter to decrease seating torques and extend seat life, thus increasing the valve's performance and reducing actuator costs.

VELOCITY LIMITS FOR ON/OFF SERVICES

FLUIDS: 30 ft/sec (9 m/s)	**GASES:** 175 ft/sec (54 m/s)

1 – **STEM RETAINING ASSEMBLY:** The stem is retained in the body by means of a unique stainless steel Spirolox® retaining ring, a thrust washer and two C-rings, manufactured from brass as standard, stainless steel upon request.

2 – **STEM BUSHING:** Non-corrosive, heavy duty acetal bushing absorbs actuator side thrust.

3 – **STEM SEAL:** Double "U" cup seal design is self-adjusting and gives positive sealing in both directions.

4 – **PRIMARY AND SECONDARY SEALS:** These seals prevent line media from coming in contact with the stem or body. The primary seal is an interference fit of the molded seat flat with the disc hub. The secondary seal is created because the stem diameter is greater than the diameter of the seat stem hole.

5 – **BODY:** One piece wafer or lug style. Polyester coating for excellent corrosion resistance. Nylon 11 coating is available as an option.

6 – **SEAT:** Bray's tongue and groove seat design provides complete isolation of flowing media from the body. The seat also features a molded o-ring which eliminates the use of flange gaskets.

7 – **DISC:** Casting is spherically machined and hand polished to provide a bubble tight shutoff, minimum torque, and longer seat life. Bray's resilient Nylon 11 coating comes as standard.

8 – **STEM:** Precision double "D" disc to stem connection drives the disc without the need for screws or pins. The close tolerance, double "D" connection that drives the valve disc is an exclusive feature of the Bray valve. Disassembly of the Bray stem is just a matter of pulling the stem out of the disc.

MATERIAL SELECTION OPTIONS

BODY	DISC	STEM	SEAT
Cast Iron✦	Nylon 11 Coated Ductile Iron✦	416 Stainless Steel✦	BUNA-N Food Grade✦
Ductile Iron✦	316 Stainless Steel✦	304 Stainless Steel	EPDM Food Grade✦
Carbon Steel	Nickel Aluminum Bronze	316 Stainless Steel	FKM*
Aluminum	Coated Ductile Iron	Monel® K500	White BUNA-N Food Grade
	Halar® Coated Ductile Iron		Bonded EPDM
	304 Stainless Steel		Bonded BUNA-N
	Duplex Stainless Steel		VITON
	Super Duplex Stainless Steel		
	Hastelloy®		

✦Standard Option

*FKM is the ASTM D1418 designation for fluorinated hydrocarbon elastomers (also called fluoroelastomers).

Monel® is a registered trademark of The International Nickel Company, Inc.

Halar® is a registered trademark of Solvay Solexis, Inc.

Hastelloy® is a registered trademark of Haynes International, Inc.

SERIES 31H

2"-20" (50mm-500mm)

Series 31H Lug valves are drilled and tapped to meet ASME Class 125/150 and PN16 flanges. Series 31H valves are designed for manual operation only.

PRESSURE RATINGS

BIDIRECTIONAL BUBBLE TIGHT SHUT OFF AND DEAD END SERVICE	
2"-20" (50-500mm)	250 psi (17.2 bar)
BODY: 250 psi (17.2 bar) CWP	

VELOCITY LIMITS FOR ON/OFF SERVICES

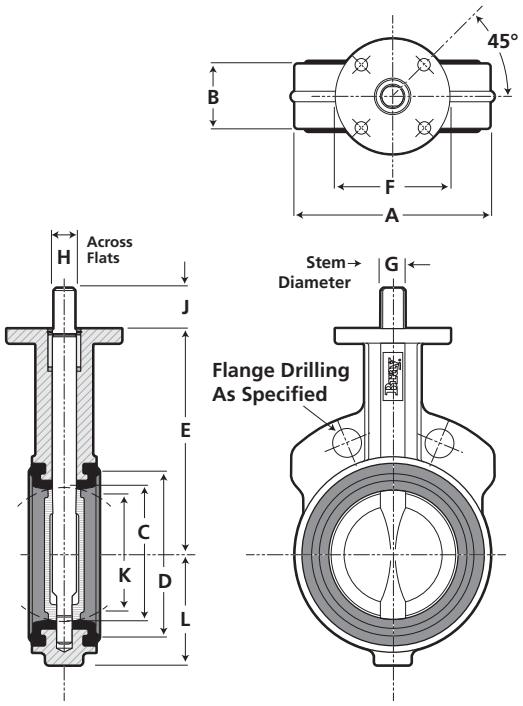
FLUIDS: 30 ft/sec (9 m/s)	**GASES:** 175 ft/sec (54 m/s)

STANDARD MATERIAL SELECTIONS

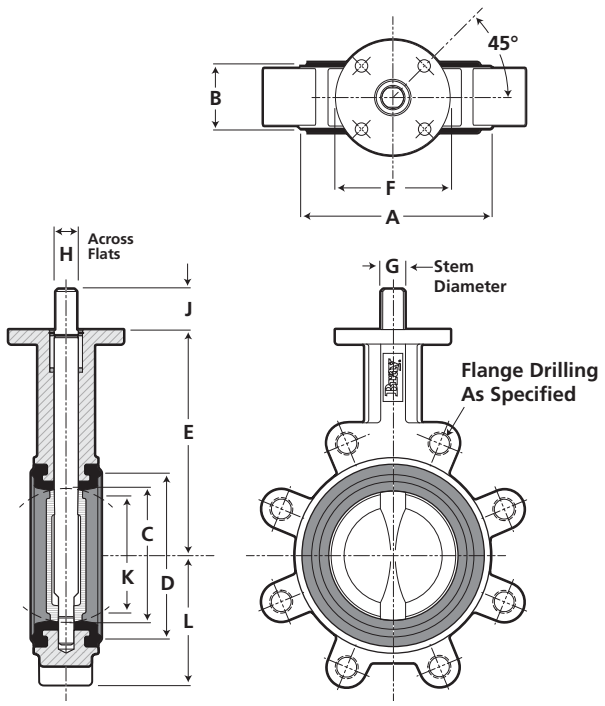
Body	Cast Iron Ductile Iron
Disc	Nickel Aluminum Bronze Nylon 11 Coated Ductile Iron 316 Stainless Steel
Stem	416 Stainless Steel
Seat	Bonded EPDM Bonded BUNA-N

Material availability depends on valve size and series. Other materials are available. Please consult your local Bray representative for your specific application.

Series 30 Wafer



Series 31 Lug



IMPERIAL DIMENSIONS: Inches																			Lug Bolting Data		
Valve Size	A	B	C	D	E	F	Top Plate Drilling			G	H	J	K	L		Adapter Code	Weight (lbs.)		Bolt Circle	No of Holes	Threads ISO Coarse
							BC	No of Holes	Hole Diameter					Wafer	Lug		Wafer	Lug			
2	3.69	1.62	2.00	2.85	5.50	3.54	2.76	4	.39	.55	39	1.25	1.32	2.22	2.30	A	5.5	7.0	4.75	4	5/8-11
2 1/2	4.19	1.75	2.50	3.36	6.00	3.54	2.76	4	.39	.55	.39	1.25	1.91	2.47	2.57	A	7.0	8.0	5.50	4	5/8-11
3	4.88	1.75	3.00	4.15	6.25	3.54	2.76	4	.39	.55	.39	1.25	2.55	2.81	2.81	A	7.5	9.0	6.00	4	5/8-11
4	6.06	2.00	4.00	5.16	7.00	3.54	2.76	4	.39	.63	.43	1.25	3.57	3.41	4.09	B	11.5	15.0	7.50	8	5/8-11
5	7.06	2.12	5.00	6.16	7.50	3.54	2.76	4	.39	.75	.51	1.25	4.63	4.03	4.61	C	14.0	20.0	8.50	8	3/4-10
6	8.12	2.12	5.75	7.02	8.00	3.54	2.76	4	.39	.75	.51	1.25	5.45	4.53	5.06	C	17.0	23.0	9.50	8	3/4-10
8	10.50	2.50	7.75	9.47	9.50	5.91	4.92	4	.57	.87	.63	1.25	7.45	5.75	6.05	D	34.0	42.0	11.75	8	3/4-10
10	12.75	2.50	9.75	11.47	10.72	5.91	4.92	4	.57	1.18	.87	2.00	9.53	7.12	7.69	E	49.0	66.0	14.25	12	7/8-9
12	14.88	3.00	11.75	13.47	12.25	5.91	4.92	4	.57	1.18	.87	2.00	11.47	8.12	9.02	E	67.0	88.0	17.00	12	7/8-9

Note: K dimension is disc chordal dimension at valve face.

METRIC DIMENSIONS: Millimeters																			Lug Bolting Data		
Valve Size	A	B	C	D	E	F	Top Plate Drilling			G	H	J	K	L		Adapter Code	Weight (Kg)		Bolt Circle	No of Holes	Threads ISO Coarse
							BC	No of Holes	Hole Diameter					Wafer	Lug		Wafer	Lug			
50	94	41.2	51	72	140	90	70	4	10	14	10	32	34	56	58	A	2.5	3	121	4	5/8-11
65	106	44.5	64	85	152	90	70	4	10	14	10	32	49	63	65	A	3	3.5	140	4	5/8-11
80	124	44.5	76	102	159	90	70	4	10	14	10	32	65	71	71	A	3.5	4	152	4	5/8-11
100	154	50.8	102	131	178	90	70	4	10	16	11	32	91	87	104	B	5	7	191	8	5/8-11
125	181	54.0	127	156	190	90	70	4	10	19	13	32	118	102	117	C	6	9	216	8	3/4-10
150	206	54.0	146	178	203	90	70	4	10	19	13	32	138	115	129	C	8	10	241	8	3/4-10
200	267	63.5	197	240	241	150	125	4	14	22	16	32	189	146	154	D	15	19	298	8	3/4-10
250	324	63.5	248	291	273	150	125	4	14	30	22	51	242	181	195	E	22	30	362	12	7/8-9
300	378	76.2	298	342	311	150	125	4	14	30	22	51	291	206	229	E	30	40	432	12	7/8-9

Note: K dimension is disc chordal dimension at valve face.

Drawings are for reference only. Please refer to Bray ES drawings on the Bray website, www.bray.com. Bray reserves the right to change product dimensions without notice.

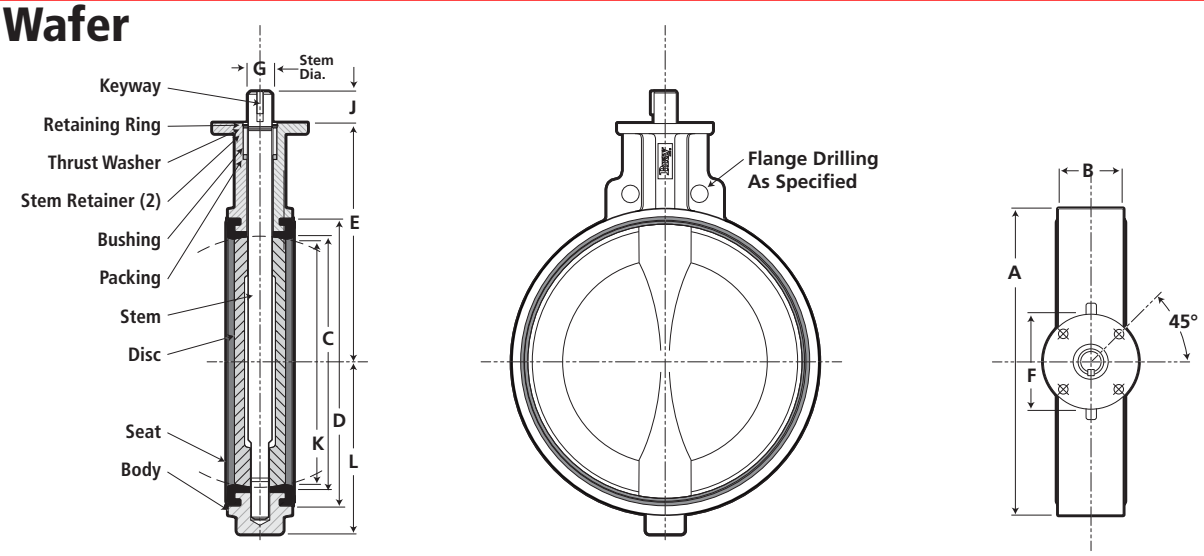
SR Drawing #30/31-2/12-in

Inquire/P.O. No.:_____

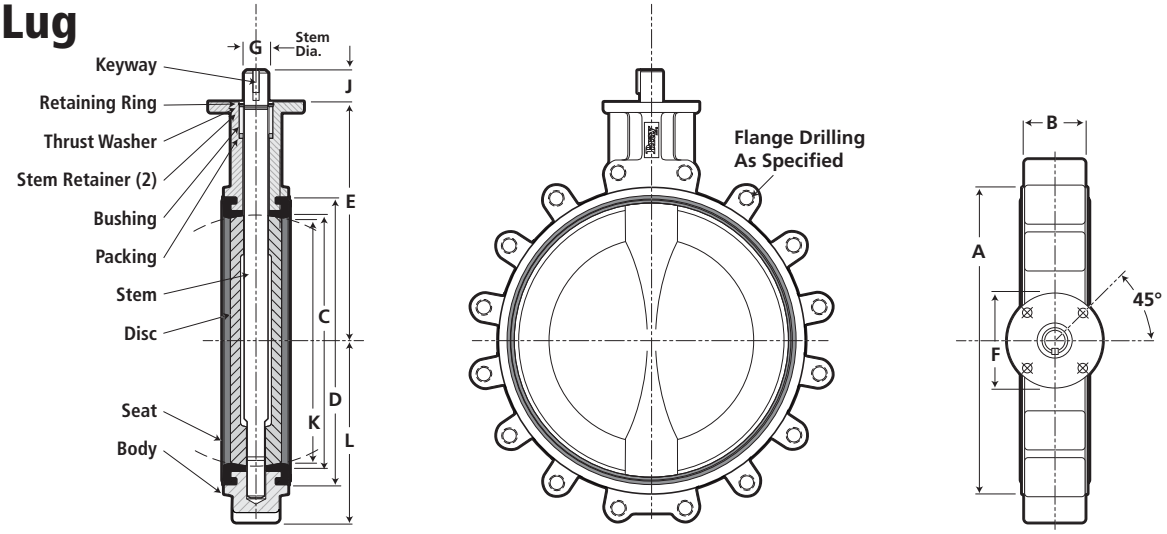
Customer/Project: _____

Bray Order No.: _____

Series 30 Wafer



Series 31 Lug



IMPERIAL DIMENSIONS: Inches																				Lug Bolting Data		
Valve Size	A	B	C	D	E	F	Top Plate Drilling			G	J	Key Size	K	L		Adapter Code	Weight (lbs.)		Bolt Circle	No of Holes	Threads ISO Coarse
							BC	No of Holes	Hole Diameter					Wafer	Lug		Wafer	Lug			
14	17.05	3.00	13.25	15.28	13.62	5.91	4.92	4	.57	1.38	2.00	.39x.39	13.04	9.38	9.93	F	95	114	18.75	12	1-8
16	19.21	4.00	15.25	17.14	14.75	5.91	4.92	4	.57	1.38	2.00	.39x.39	14.85	10.75	11.30	F	135	166	21.25	16	1-8
18	21.12	4.25	17.25	19.47	16.00	8.27	6.50	4	.81	1.97	2.50	.47x.39	16.85	12.00	12.15	G	200	226	22.75	16	1⅛-7
20	23.25	5.00	19.25	21.59	17.25	8.27	6.50	4	.81	1.97	2.50	.47x.39	18.73	14.00	14.00	G	260	305	25.00	20	1⅛-7

Note: K dimension is disc chordal dimension at valve face.

METRIC DIMENSIONS: Millimeters																				Lug Bolting Data		
Valve Size	A	B	C	D	E	F	Top Plate Drilling			G	J	Key Size	K	L		Adapter Code	Weight (Kg)		Bolt Circle	No of Holes	Threads ISO Coarse
							BC	No of Holes	Hole Diameter					Wafer	Lug		Wafer	Lug			
350	433	76.2	337	388	346	150	125	4	14	35	51	10x10	331	238	252	F	43	52	476	12	1-8
400	488	101.6	387	442	375	150	125	4	14	35	51	10x10	377	273	287	F	61	75	540	16	1-8
450	536	108.0	438	495	406	210	165	4	21	50	64	12x10	428	305	309	G	91	103	578	16	1⅛-7
500	591	127.0	489	548	438	210	165	4	21	50	64	12x10	476	348	358	G	118	138	635	20	1⅛-7

Note: K dimension is disc chordal dimension at valve face.

Drawings are for reference only. Please refer to Bray ES drawings on the Bray website, www.bray.com. Bray reserves the right to change product dimensions without notice.

SR Drawing #30/31-14/20-in

Inquire/P.O. No.:_____

Customer/Project: _____

Bray Order No.: _____

Bray
THE HIGH PERFORMANCE COMPANY

BRAY INTERNATIONAL
PRIMARY SALES AND SERVICE LOCATIONS

USA
Houston, Texas

AFRICA
Johannesburg

BENELUX
Heerhugowaard

BRAZIL
Paulinia, Sao Paulo

CANADA
Montreal

CHILE
Santiago

CHINA
Hangzhou, Zhejiang

COLOMBIA
Bogotá

FRANCE
Voiron

GERMANY
Krefeld

INDIA
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Milano

MEXICO
Zapopan, Jalisco

MIDDLE EAST
Dubai

PACIFIC
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PERU
Lima

POLAND
Oświęcim

RUSSIA
Moscow

SINGAPORE
Ubi Techpark

SOUTH KOREA
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SOUTHEAST ASIA
Malaysia

UNITED KINGDOM
Glasgow

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USA
Houston, Texas

BRAZIL
Paulinia, Sao Paulo

CHINA
Hangzhou, Zhejiang

RITE CORPORATION

CANADA
Montreal

VALVTRONIC

ARGENTINA
Buenos Aires

AMRESIST

USA
Houston, Texas

KUGELHAHN MÜLLER

GERMANY
Krefeld

HEADQUARTERS
Bray International, Inc.
13333 Westland East Blvd.
Houston, Texas 77041
Tel: 281.894.5454
bray.com

B-1050_EL_Resilient Seated Valves_4_2019

Bray CONTROLS

MANUAL OPERATORS

Bray Controls offers three operators for manual control of valve position. All manual operators mount directly to Bray valves, and all are epoxy coated for excellent corrosion, abrasion and impact resistance.

MANUAL OPERATORS	
SERIES 01 - Handle	1"-12" (25mm -300mm)
SERIES 04 - Gear Operator	2"-48" (50mm -1200mm)
SERIES 05 - Declutchable Gear Operator	2"-36" (50mm -900mm)

SERIES 01 - HANDLE & NOTCH PLATE

Bray offers two handles for on-off and throttling service – one for resilient seated valves from 1"-12" (25mm-300mm), and a high torque handle for high pressure valves from 2½"- 8" (65mm-200mm). These quarter turn handles have a locking spring and a directional pointer for valve disc position indication. Bolted notch plates are offered. For resilient seated valves a 10 position plate is standard. For high pressure valves a 9 position plate is standard. Both contain on-off stops to prevent over rotation of the valve. Optionally available are an infinite position plate, a 180° notch plate, a memory stop, a padlock kit, and a 2" square nut version.

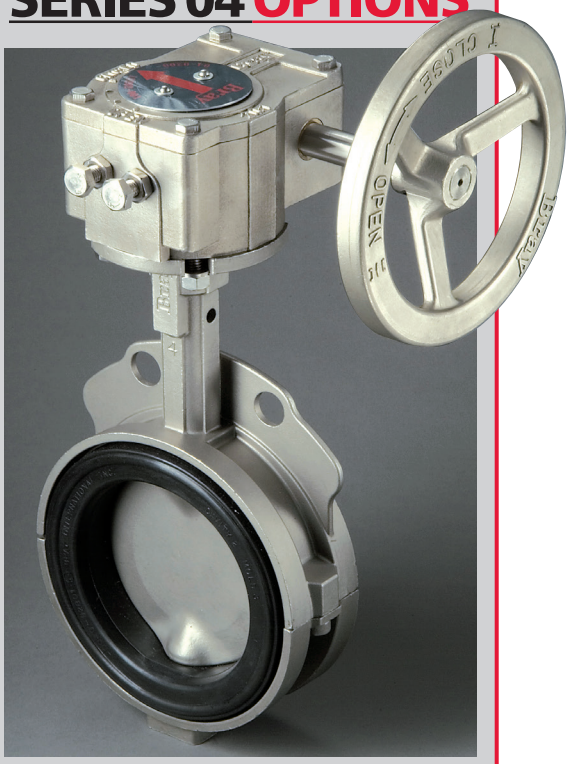
SERIES 04 - GEAR OPERATOR

For heavy duty on-off and throttling service of 2"-48" (50mm-1200mm) valves, the Series 04 is self lubricated for smooth, trouble-free operation. The rugged, cast iron body with O-ring body seals is weatherproof to IP65. A self-locking worm and worm gear drive holds the valve in the desired position. Features include a readily accessible handwheel, a valve position indicator and mechanical travel stops which permit field adjustment of valve movement to specific degrees of rotation. Optionally available are chainwheel accessories, padlock kits and 2" square nut versions. A Gear Operator with a stainless steel housing is also available for valve sizes 1"-16".

SERIES 05 - DECLUTCHABLE GEAR OPERATOR

Available for 2"-36" (50mm-900mm) valves. This operator is excellent for the safe handling of spring return actuators. During pneumatic operation, the worm of the gear unit is disengaged. Should the valve require opening or closing in the event of power loss, manual rotation of the declutch lever will provide a camming action and engage the worm to the segmented worm gear, allowing rotation of the valve using the handwheel. The Series 05 can be installed in the field with existing Bray pneumatic actuators.

SERIES 04 OPTIONS



316 Stainless Steel
for sanitary & corrosive applications

Bray Controls proudly offers the Series 04 Stainless Steel Gear Operator for manual operation of quarter turn valves. With stainless steel housings, input shafts and handwheels, the Series 04 is designed for service in highly corrosive environments, sanitary, breweries and pharmaceutical applications. The units are suitable for on-off and throttling service.

Series 04 Stainless Steel Gear Operator units have different gear ratios – providing a torque output range of 2,000 to 24,000 lb-in. The temperature range is -4°F (-20°C) to 250°F (120°C).

These weatherproof gear operators meet NEMA 4, 4x and IP 65 specifications.

CHAINWHEEL for remote access to valve positioning when the handwheel is not accessible, such as valves positioned high out of reach.

~~**A PADLOCK KIT & 2" SQUARE NUT** version for buried service are also available with the Series 04 (not shown).~~

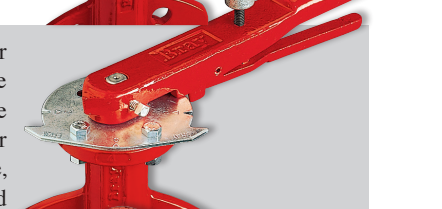
SERIES 01

STANDARD 10 POSITION NOTCH PLATE has been designed to lock the handle securely in place, preventing position change of disc due to line pressure, vibration or shock. Standard 9 Position Plate for high pressure valves is not shown.

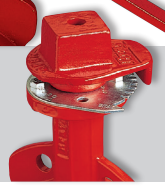
PADLOCK KIT allows the customer to lock the valve in the full open or closed position, tamper proofing the valve. By drilling a new hole in the top plate, the handle can be locked in mid travel.

HANDLE AND 180° NOTCH PLATE allows the operator to switch the handle to either side without removing the notch plate from the valve.

INFINITE POSITION NOTCH PLATE for throttling applications, allows for very precise adjustments of valve disc positioning anywhere from 0° to 90°. Positioning is simply a matter of loosening the set knob, moving the handle, then retightening the knob. For resilient seated valves only.



MEMORY STOP allows the operator to set the maximum amount the valve can open. When set, this limit will remain fixed until the stop is reset.

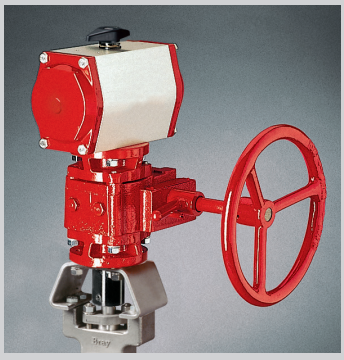


2" SQUARE NUT is used where the valve is buried under the surface. To rotate valve disc position, the nut is reached with a T-handle wrench.

SERIES 05

DECLUTCHABLE GEAR OPERATOR

The Series 05 offers the same superior features as the Series 04 gear operator with the added ability to manually override pneumatic actuators or rotate the valve when air pressure is not available.



Bray® CONTROLS
A Division of BRAY INTERNATIONAL, Inc.
13333 Westland East Blvd. Houston, Texas 77041
281.894.5454 FAX 281.894.9499 www.bray.com

 B-1025_EL_ManualOPS_2014-08

SECTION 4.11

DISCHARGE CHECK VALVE

Lone Star Blower
8883 West Monroe
Houston, TX 77061

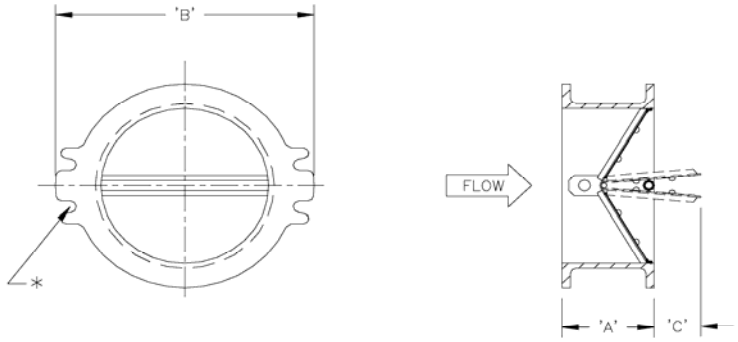
PH: 832-532-3112
FAX: 832-532-3115

Flexi-Hinge® Valve Co., Inc.

2450 Dutch Road, Fairview, PA 16415
814.474.3539 • Fax 814.474.3532
www.flexi-hinge.com

Series 518 Flexi-Hinge® Check Valve

WAFER STYLE CLASS 125#



*BOLTING CONFORMS TO ANSI B16.1 AND B16.5

SPECIFICATIONS

SIZE [mm]	MODEL NO.	A [mm]	B [mm]	C [mm]	Weight -lbs. [Kg.]	Cv [l/m]
14" [356]	-518	7.375 [187]	21 [533]	3 3/8" [86]	175 [79]	13420 [50728]
16" [406]	-518	8.375 [213]	23.5 [597]	3 15/16" [100]	220 [99]	15910 [60226]
18" [457]	-518	9.375 [238]	25 [635]	4 1/2" [114]	260 [117]	18750 [70976]
20" [508]	-518	10.375 [264]	27.5 [699]	5 1/4" [133]	320 [144]	29680 [112190]
24" [610]	-518	12.375 [314]	32 [813]	6 1/4" [159]	410 [185]	40950 [154791]

Note: Dimensions subject to change. Request certified drawings.

*Outside diameter conforms to ANSI B16.1
and 16.5 flange dimensions as a wafer style assembly.

Note: Maximum Working Pressure is 200 psi at 150°F

AVAILABLE MATERIALS

BODY		INTERNALS	
-1	Carbon Steel	2	316 S/S Steel
-2	316 S/S Steel	3	Aluminum
-3	Aluminum		
-4	Cast Iron		

Standard hardware is aluminum
Standard seal material is Buna-N

Seals		Options	
1	Buna-N	0	No Spring
2	EPDM	1	S/S Spring
3	Silicone	2	Special
4	Viton		

(1) See general catalog for temperature limitations

Consult Factory for Sizes, Materials, Pressure Ratings and Combination End Configurations Not Shown

April 2011

Flexi-Hinge® Check Valves

PRESSURE LOSS CHARTS
WATER AND AIR APPLICATIONS

[SEE TECHNICAL SECTION FOR OTHER LIQUIDS AND GASES]

April 2011

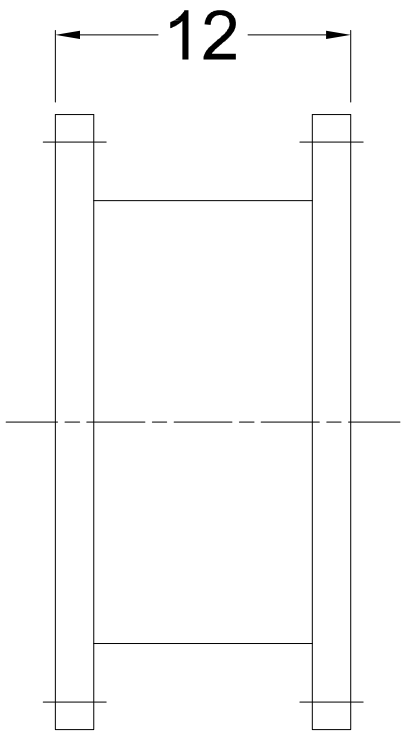
SECTION 4.12

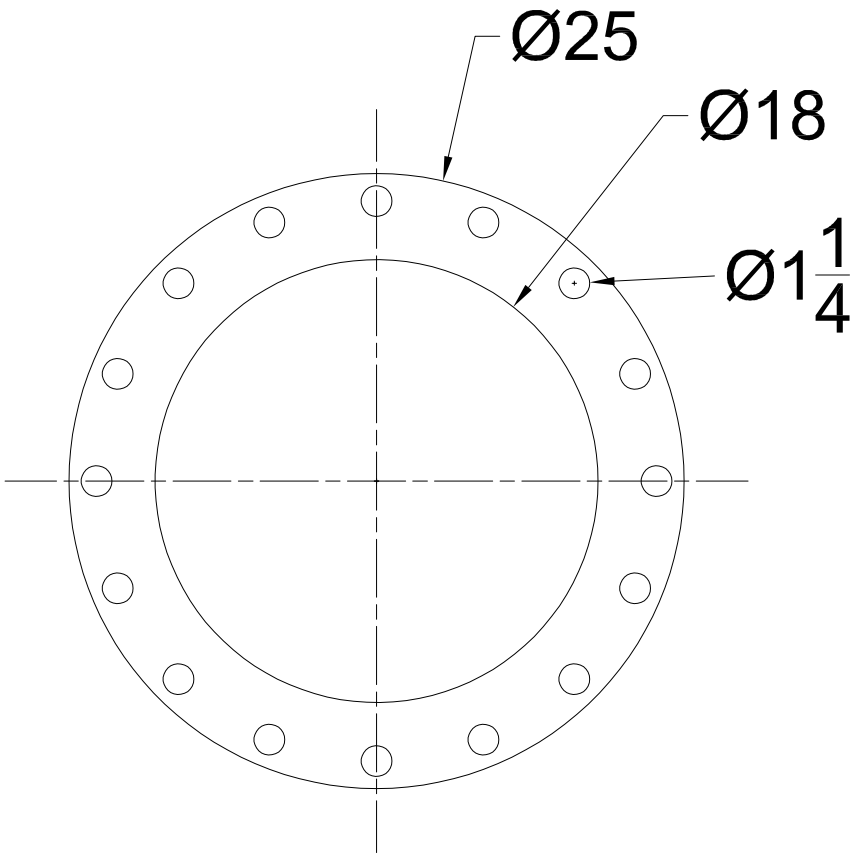
DISCHARGE SPOOL PIECE

Lone Star Blower
8883 West Monroe
Houston, TX 77061

PH: 832-532-3112
FAX: 832-532-3115

REVISION HISTORY			
REV	DESCRIPTION	DATE	APPROVED





NOTES:

1) SPOOL PIECE REQUIRES PIPE SUPPORTS TO SUPPORT SPOOL PIECE WEIGHT.

THIRD ANGLE PROJECTION

DRAWING IS FOR REFERENCE ONLY UNLESS SPECIFIED AS RELEASED.

APPROVALS		
DRAWN	ADW	03/04/2021
CHECK		
ENGINEER		
MANUFACTURING		
CONTROL		
APPROVED		

LONE STAR BLOWER

TITLE
18" SPOOL PIECE; 12" F/F
LS24-5

SIZE	CAGE CODE	DWG NUMBER	REV
A	-	S20-12175-DCSPOOL	0

SCALE

SHEET 1 OF 1

SECTION 4.13

BEARING VIBRATION SENSORS

Lone Star Blower
8883 West Monroe
Houston, TX 77061

PH: 832-532-3112
FAX: 832-532-3115

Model Number
HT640M80

LOOP POWERED CURRENT OUTPUT SENSOR

Revision:
ECN #:

PERFORMANCE	ENGLISH	SI	
Measurement Range	0.0 – 1.0 in/s pk	0.0 – 25.4 mm/s pk	[1]
Output	4 - 20 mA	4 - 20 mA	
Frequency Response (±10%)	180 - 90,000 cpm	3 Hz - 1.5 kHz	[2] [3]
Broadband Resolution	0.005 in/s pk	0.13 mm/s pk	[4]
Non-Linearity	±1%	±1%	
ENVIRONMENTAL			
Temperature Range	-40 to +257 °F	-40 to +125 °C	
ELECTRICAL			
Excitation Voltage	12 to 30 VDC	12 to 30 VDC	
Load Resistance	50 (Vs-12) ohms	50 (Vs-12) ohms	
Settling Time (within 2% of value)	<15 sec	<15 sec	
Electrical Isolation (Case)	$>10^8$ ohms	$>10^8$ ohms	
MECHANICAL			
Size (Diameter x Height)	1.50 x 3.93 in	38.1 x 99.8 mm	
Weight	1.2 lbs	544 gm	
Mounting Thread	½-14 NPT	Not Applicable	
Sensing Element	Ceramic	Ceramic	
Sensing Geometry	Shear	Shear	
Housing Material	Stainless Steel	Stainless Steel	
Electrical Connector	Terminal Block	Terminal Block	
Electrical Connector Position	Top	Top	
Electrical Connections (Tab 1)	4-20mA Pos	4-20mA Pos	
Electrical Connections (Tab 2)	4-20mA Neg	4-20mA Neg	
Screw Terminal Wire Size	12-24 AWG	3.0 - .2mm²	
Conduit Housing Thread	1” NPT	Not Applicable	

CE [5]

OPTIONAL VERSIONS

Optional versions have identical specifications and accessories as listed for the standard model except where noted below. More than one option may be used.

-None-

NOTES:

[1] Conversion Factor 1 in/sec = 0,0254 m/sec.
[2] 1 Hz = 60 cpm (cycles per minute).
[3] Current will fluctuate at frequencies below 5 Hz.
[4] Typical value.
[5] See PCB Declaration of Conformance PS039 for details.

Hazardous Area Certification

-None-

SUPPLIED ACCESSORIES:

Model ICS-4 NIST-traceabe single-axis amplitude response calibration from 0cpm (0Hz) to upper 10% frequency for 4-20mA output vibration sensor

All specifications are at room temperature unless otherwise specified.

Form DD030 Rev.F 2/23/99

Drawn:	Engineer:	Sales:	Approved:	Spec Number:
Date:	Date:	Date:	Date:	**35476**

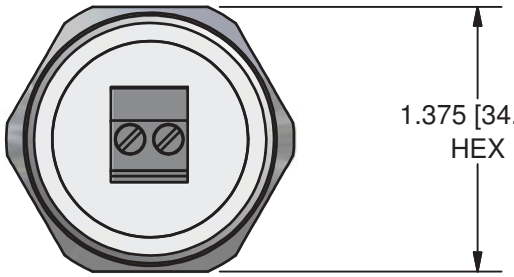
PCB PIEZOTRONICS INC. IMI DIVISION

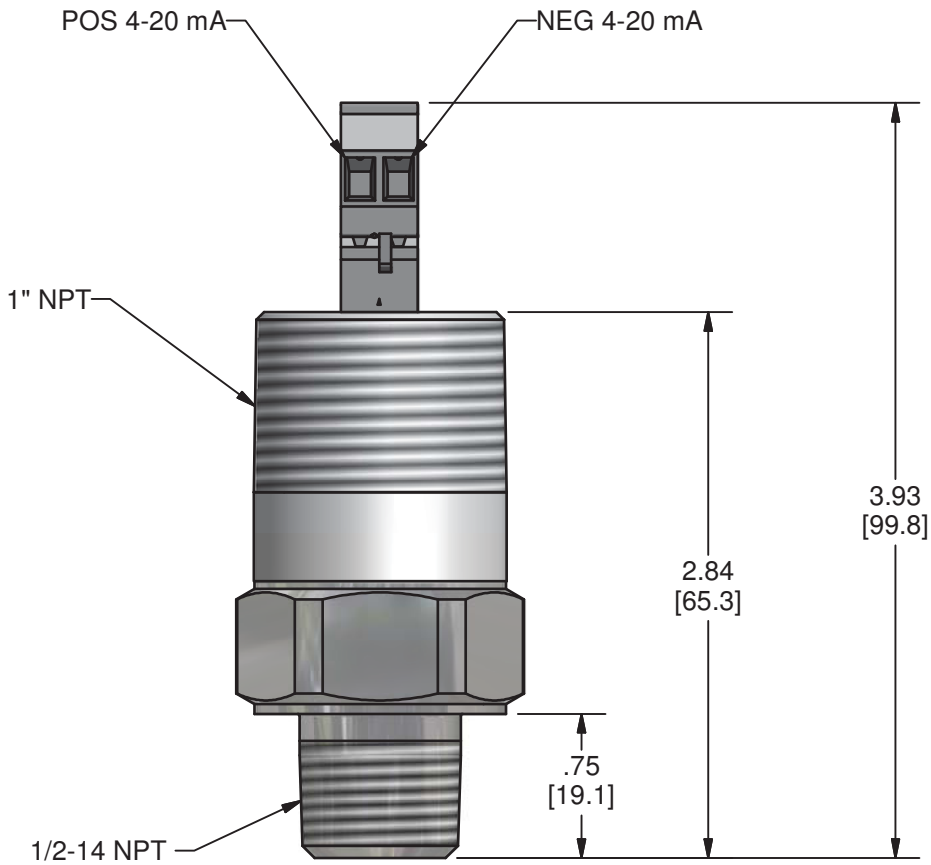
3425 Walden Avenue, Depew, NY 14043 800-959-4464 Fax (716) 684-3823 E-Mail: imisales@pcb.com

APPLICATION		
NEXT ASS'Y	USED ON	VAR

REVISIONS			
REV	DESCRIPTION	ECN	APP'D
LAB2	AS PER CUSTOMER NPT TO NPSM		
LAB3	AS PER CUSTOMER NPSM TO NPT		

35477





CUSTOMER APPROVAL

CUSTOMER SIGNATURE

PRINT YOUR NAME HERE

TITLE DATE

UNLESS OTHERWISE SPECIFIED TOLERANCES ARE:

DIMENSIONS IN INCHES	DIMENSIONS IN MILLIMETERS [IN BRACKETS]
DECIMALS XX ± .03	DECIMALS X ± 0.8
XXX ± .010	XX ± 0.25
ANGLES ± 2 DEGREES	ANGLES ± 2 DEGREES
FILLETS AND RADII .003 - .005	FILLETS AND RADII [0.07 - 0.13]

DRAWN			MFG		
CHK'D			ENGR		
APP'D			SALES		

TITLE PRELIMINARY DRAWING

MODEL HT640M80
4-20 mA VELOCITY SENSOR

PCB PIEZOTRONICS INC.
3425 WALDEN AVE. DEPEW, NY 14043
(716) 684-0001 E-MAIL: sales@pcb.com

CODE IDENT. NO.	DWG. NO.
52681	35477
SCALE: FULL	SHEET 1 OF 1

SECTION 4.14

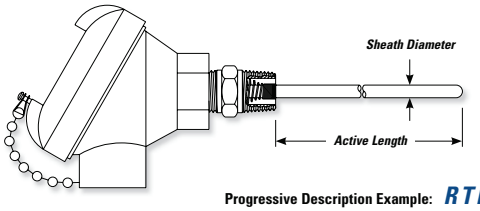
BEARING TEMPERATURE SENSORS

Lone Star Blower
8883 West Monroe
Houston, TX 77061

PH: 832-532-3112
FAX: 832-532-3115

TERMINAL HEAD AND SPRING LOADED MOUNTING ■ RTD ASSEMBLIES 500SB

Conax spring-loaded assemblies are used to maintain positive contact between the sensor tip and the surface to be monitored, typically used with thermowell assemblies. Conax supplies a number of styles of spring-loaded assemblies to meet application needs. Spring-loaded assemblies can be provided with all terminal heads. In addition, the T11SL model provides a spring-loaded assembly built into the T11 aluminum terminal head. This allows complete disassembly and removal of the sensor probe without dismantling the terminal head from the conduit or the vessel.
For detailed information on these mounting styles, see pages 40-41.



Progressive Description Example: RTD43W3-316SS25-T5AL(CSLW)-12.00"

Sensor Element | 'W' Sensor Tolerance | '3' Sensor Lead Configuration | 0.250" 316 Stainless Steel Sheath | T5 Aluminum Termination | Mounting Style | Length

ERTD43

Specify Sensor Element

RTD43 Platinum
- 100Ω @ 0° C
- α = 0.00385 Ω/Ω/°C
- -200° C to +600° C
- -328° F to +1112° F

MRTDF43 Platinum
- 100Ω @ 0° C
- α = 0.00385 Ω/Ω/°C
- -50° C to +550° C
- -58° F to +1022° F

RTD44 Platinum
- 100Ω @ 0° C
- α = 0.00385 Ω/Ω/°C
- -200° C to +800° C
- -328° F to +1472° F
- Inconel 600 sheath standard

RTD45 Platinum
- 100Ω @ 0° C
- α = 0.003916 Ω/Ω/°C
- -200° C to +600° C
- -328° F to +1112° F

RTD86 Platinum
- 200Ω @ 0° C
- α = 0.00385 Ω/Ω/°C
- -200° C to +600° C
- -328° F to +1112° F

MRTDF430 Platinum
- 1000Ω @ 0° C
- α = 0.00385 Ω/Ω/°C
- -50° C to +550° C
- -58° F to +1022° F
- Available with 0.250" sheath diameter or larger

Note: For ASTM E1137 assemblies, use ordering prefix ARTD44W4-SS25 or ARTD44W4-INC25.

W

Specify Sensor Tolerance

W (Class B)
- Available for RTD43, 44 and 45, single and dual; and RTD86, MRTDF43 and MRTDF430, single only
- Tolerance at 0° C is ±0.3° C

V (1/3 Class B)
- Available for RTD43, 44 and 45 single only
- Tolerance at 0° C is ±0.1° C

S (Class A)
- Available for RTD43, 44 and 45 single only
- Tolerance at 0° C is ±0.15° C

X
- Available for ERTD41, single only; tolerance at 0° C is ±0.4° C
- Available for ERTD42, single; tolerance at 0° C is ±0.8° C
- Available for ERTD42, dual; tolerance at 0° C is ±1.4° C

ERTD41 Copper
- 10Ω (9.05Ω actual) @ 0° C
- α = 0.00426 Ω/Ω/°C
- -70° C to +150° C
- -94° F to +300° F
- Available with 0.250" sheath diameter or larger

ERTD42 Nickel
- 120Ω @ 0° C
- α = 0.00672 Ω/Ω/°C
- -40° C to +180° C
- -40° F to +350° F
- Available with 0.250" sheath diameter or larger

3

Specify Sensor Lead Configuration

2 — RED, WHITE — 2-WIRE SINGLE

3 — RED, RED, WHITE — 3-WIRE SINGLE

4 — RED, RED, WHITE, WHITE — 4-WIRE SINGLE

6 — RED, RED, WHITE, WHITE — 2-WIRE DUAL

7 — RED, RED, RED, WHITE, WHITE — 3-WIRE DUAL

8 — RED, RED, RED, RED, WHITE, WHITE, WHITE, WHITE — 4-WIRE DUAL

Note: 0.125" and 0.187" diameter sheaths can contain up to 4 wires; 0.250" diameter sheaths can contain up to 8 wires.

SS25

Specify Sheath Material & Size

316 Stainless Steel

316SS118
- 3 mm

316SS12
- 0.125" diameter

316SS18
- 0.187" diameter

316SS236
- 6 mm

316SS25
- 0.250" diameter

Inconel 600

INC12
- 0.125" diameter
- Standard sheath material for RTD44

INC18
- 0.187" diameter
- Standard sheath material for RTD44

INC25
- 0.250" diameter
- Standard sheath material for RTD44

Note: For additional diameters and other sheath materials, see page 7.

T5AL(5333A)

Specify Termination Style

T5AL - Aluminum
T5CI - Cast Iron
- NEMA 4 rated
- Conduit port 3/4 NPT

T5SS
- NEMA 4X rated
- 316 stainless steel construction
- Conduit port 3/4 NPT

T7
- Weather proof
- Aluminum conduit box accommodates up to 8 terminals
- Conduit port 3/4 NPT

T8E
- Explosion proof rating Class I, Group B, C & D Class II, Group E, F & G Class III
- Gray iron body with aluminum screw cover
- NEMA 4 rated
- Conduit port 1/2 NPT

T11
- Weather proof
- Aluminum construction
- Conduit port 1/2 NPT

T11PL
- Weather proof
- Plastic construction
- Conduit port 1/2 NPSM

T12
- Weather proof
- Aluminum construction
- Flip-top head
- Conduit port 1/2 NPT

T13T
- FDA compliant, NEMA 4X rated
- White, unpigmented polypropylene construction
- 4 terminal posts
- Conduit port 3/4 NPT

T15EAL - Aluminum
T15ESS - Stainless Steel
T15EAL(ATEX)
- Explosion Proof rating Class 1, Division 1, Groups B, C and D and Dust Proof/Ignition Proof rating for Class II, Division 1, Group E, F & G
- Ratings: T15EAL – NEMA 4, T15ESS – NEMA 4X
- Conduit port 3/4 NPT

Note: For additional terminal head types and detailed descriptions, see pages 43-47.

(CSLW)

Specify Mounting Style

CSLW
- For 0.125", 0.187" and 0.250" diameter sheaths
- Stainless steel construction
- Mounting thread 1/2 NPT

SLAN
- For 0.125", 0.187" and 0.250" diameter sheaths
- Stainless steel construction
- Mounting thread 1/2 NPT
- Probe position can be adjusted in the field

SLANS
- For 0.250" diameter sheath
- Includes Viton O-ring
- Stainless steel construction

[ ]

Specify Length in Inches (required)

SLN
- For 0.125", 0.187" and 0.250" diameter sheath
- Mounting thread 1/2 NPT
- Most durable

SL
- Spring-loaded packing gland
- Spring travel: 1/4" to 3/8"
- 2-8 pounds spring pressure
- Stainless steel construction, Teflon sealant
- Available with B cap for direct mount
- *Additional dimensional data required, see page 40.*

SL12
- For 0.125" diameter sheath
- Mounting thread 1/8 NPT

SL18
- For 0.187" diameter sheath
- Mounting thread 1/4 NPT

SL25
- For 0.250" diameter sheath
- Mounting thread 1/2 NPT
- Optional 1/4 NPT mounting thread is available. Consult factory.

For additional information on spring-loaded mounting styles, see pages 40-41.

ERTD43W3-SS25-T5AL5333A(CSLW)-.50-260S-U2.50-S316(0/350F)

CSLW = Spring loaded fitting for use with thermowell. 316SST thermowell has .50" NPT mounting thread and U=2.50"

✆ Tel: 1.716.684.4500 • USA: 1.800.223.2389 • Website: www.conaxtechnologies.com Conax TECHNOLOGIES

2-Wire Programmable Transmitter
Model 5333A

- **RTD or Ohm Input**
- **High Measurement Accuracy**
- **3-Wire Connection**
- **Programmable Sensor Error Value**

Application:

- Linearized temperature measurement with Pt100... Pt1000 or Ni100...Ni1000 sensor.
- Conversion of linear resistance variation to a standard analog current signal.

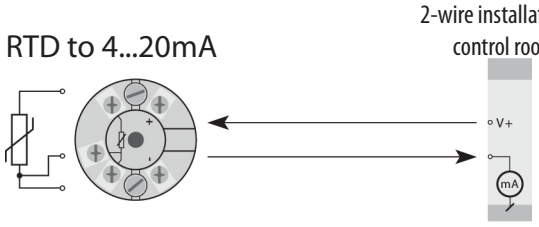
Technical Characteristics:

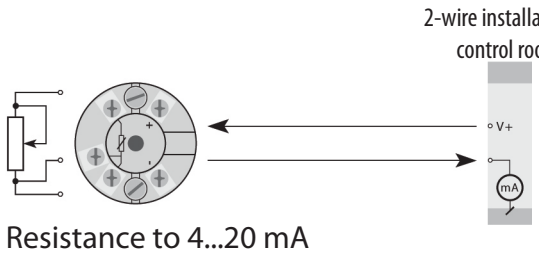
- Within seconds the user can program a 5333A to measure temperatures within all standard RTD sensor ranges.
- The RTD and resistance inputs have cable compensation for 3-wire connections.

Mounting / Installation:

- DIN Form B sensor head compatible.
- Supplied with 2 x M4 screws on a 33 mm(1.3") BC (optional 6-32 screws available).

RTD to 4...20mA





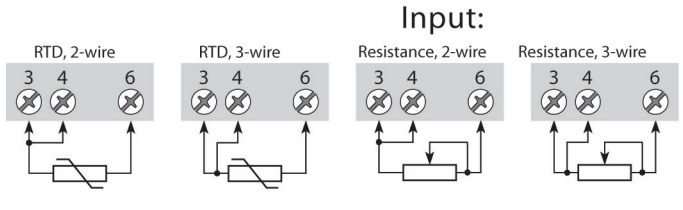
Resistance to 4...20 mA

Tel: **1.716.684.4500** • USA Toll Free: **1.800.223.2389** • Email: **sales@conaxtechnologies.com** • Website: **www.conaxtechnologies.com**

Specifications

Order: 5333A

Connections:



Electrical Specifications:
Specifications Range: -40°C to +85°C
Common Specifications:
Supply voltage, DC ..... 8.0...35 V
Internal consumption ..... 25 mW...0.8 W
Voltage drop ..... 8 VDC
Warm-up time ..... 5 min.
Communications interface ..... Loop Link
Signal / noise ratio ..... Min. 60 dB
Response time (programmable) ..... 0.33...60s
Signal dynamics, input ..... 19 bit
Signal dynamics, output ..... 16 bit
Calibration temperature ..... 20...28°C
Accuracy, the greater of general and basic values:

General Values		
Input Type	Absolute Accuracy	Temperature Coefficient
All	≤ ±0.1% of span	≤ ±0.01% of span / °C

Basic Values		
Input Type	Basic Accuracy	Temperature Coefficient
RTD	≤ ±0.3°C	≤ ±0.01°C/ °C
Lin. R	≤ ±0.2 Ω	≤ ±20 mΩ/°C

EMC immunity influence ..... ≤ ±0.5% of span

Effect of supply voltage variation..... ≤ 0.005% of span / VDC
Vibration ..... IEC 60068-2-6 Test FC
Lloyd's specification no. 1 ..... 4 g / 2...100 Hz
Max wire size ..... 1 x 1.5mm^2(16 AWG) stranded wire
Humidity ..... < 95% RH (non-cond.)
Dimensions ..... Ø 44 x 20.2 mm
Protection degree (encl. / terminal) ... IP68 / IP00
Weight..... 50 g

Electrical Specifications, Input:
RTD and Linear Resistance Input:

RTD Type	Min. Value	Max. Value	Min. Span	Standard
Pt100	-200°C	+850°C	25°C	IEC 60751
Ni100	-60°C	+250°C	25°C	DIN 43760
Lin. R	0 Ω	10000 Ω	30 Ω	------

Max. offset ..... 50% of selected max. value
Cable resistance per wire (max.) ..... 10 Ω
Sensor current ..... > 0.2 mA, < 0.4 mA
Effect of sensor cable resistance
(3-wire) ..... < 0.002 Ω / Ω
Sensor error detection ..... Yes
Output:
Current Output:
Signal range ..... 4...20 mA
Min. signal range ..... 16 mA
Updating time ..... 135 ms
Load resistance ..... ≤ (Vsupply- 8) / 0.023 [Ω]
Load stability ..... < ±0.01% of span/100 Ω
Sensor Error Detection:
Programmable ..... 3.5...23 mA
NAMUR NE43 Upscale ..... 23 mA
NAMUR NE43 Downscale ..... 3.5 mA
Marine Approval:
Det Norske Veritas, Ships & Offshore ..... Standard for Certific. No. 2.4
Observed Authority Requirements: **Standard:**
EMC 2004/108/EC
Emission and immunity ..... EN 61326

Of span = Of the presently selected range
Loop Link = PC compatible programming software.

Request catalog 5005, our RTD & Thermocouple Assemblies Resource Guide

Visit www.conaxtechnologies.com for technical data on temperature sensors, thermocouples, RTDs, thermowells, transmitters, special assemblies and more.

Conax TECHNOLOGIES®

ISO 9001:2008 SGS

2300 Walden Avenue
Buffalo, New York 14225, USA
Fax: 716-684-7433 • Tel: 716-684-4500
Toll free in the USA at 1-800-223-2389
E-mail: sales@conaxtechnologies.com
Website: www.conaxtechnologies.com

SECTION 4.15

INLET DIFFERENTIAL PRESSURE TRANSMITTER

Lone Star Blower
8883 West Monroe
Houston, TX 77061

PH: 832-532-3112
FAX: 832-532-3115

SERIES MS2 | MAGNESENSE® II DIFFERENTIAL PRESSURE TRANSMITTER

FEATURES/BENEFITS

- **Field selectable ranges and output signal reduce inventory and the chances of ordering an incorrect part**
- **BACnet or Modbus serial communications reduce wiring cost by daisy-chaining the transmitters**
- **Our integral field-upgradeable display or plug-in remote display tool save upfront material cost and allow for local viewing of measurements**

APPLICATIONS

- Filter monitoring in air handler units
- Building pressure in pharmaceutical-semi-conductor clean rooms
- Duct static pressure in commercial buildings
- Air velocity/flow in VAV systems

DESCRIPTION

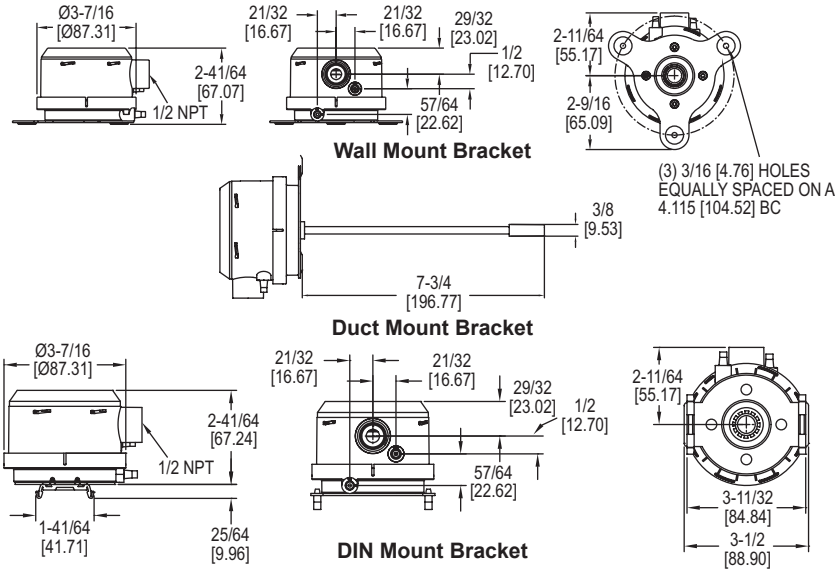
The **Series MS2 Magnesense® II Differential Pressure Transmitter** combines the proven stable piezo technology and the versatility of our original Series MS with additional features to reduce installation time and simplify ordering. Like the original Series MS, the second generation transmitter can be used as a linear pressure output or a linear velocity output with the square root extraction done in the transmitter. Additional parameters have been included to expand the square root capability to include flow measurements.

SPECIFICATIONS

Supported Baud Rates	9600, 19200, 38400, 57600, 76800, 115200.
Data Size	8.
Parity	None.
Stop Bits	1.
Service	Air and non-combustible, compatible gases.
Wetted Materials	Consult factory.
Typical Accuracy	±1% FS for 0.15 in w.c. (40 Pa), 0.25 in w.c. (50 Pa), 0.5 in w.c. (100 Pa), 2 in w.c. (500 Pa), 3 in w.c. (750 Pa), 5 in w.c. (1250 Pa), 10 in w.c. (2 kPa), 15 in w.c. (3 kPa), 25 in w.c. (5 kPa), 28 in w.c. (6.975 kPa); ±2% FS for 0.1 in w.c. (25 Pa), 1 in w.c. (250 Pa), and all bi-directional ranges.
Stability	±1% / year FSO.
Temperature Limits	0 to 150°F (-18 to 66°C).
Pressure Limits	1 psi max., operation; 10 psi burst.
Power Requirements	10 to 35 VDC (2-wire), 17 to 36 VDC or isolated 21.6 to 33 VAC (3-wire).
Output Signals	4 to 20 mA (2-wire), 0 to 5 VDC, 0 to 10 VDC (3-wire).
Response Time	Adjustable: 0.5 to 15 sec. time constant. Provides a 95% response time of 1.5 to 45 seconds.
Zero & Span Adjustments	Digital push buttons.
Loop Resistance	Current output: 0 to 1250 Ω max; Voltage output: Min. load resistance 1 kΩ.
Current Consumption	40 mA max.
Display (Optional)	5 digit LCD.
Electrical Connections	3-wire removable European style terminal block for 16 to 22 AWG.
Electrical Entry	1/2″ NPS thread.
Process Connection	3/16″ ID tubing (5 mm ID); Max. OD 9 mm.
Enclosure Rating	IP66.
Mounting Orientation	Not position sensitive.
Weight	8.0 oz (230 g).
Agency Approvals	BTL, CE.

DWYER INSTRUMENTS, INC.
T: 219-879-8000 | F: 219-872-9057 | info@dwyermail.com
800-872-9141

DIMENSIONS



HOW TO ORDER

Use the **bold** characters from the chart below to construct a product code.

MS2 **-W** **101** **-LCD**

MS2-W102-LCD

SERIES
MS2: Magnesense® II differential pressure transmitter

PROBE
-W: Wall mount bracket
-D: Duct mount bracket
-N: DIN mount bracket

*Bidirectional ranges for W and N. Unidirectional ranges for D.

OPTIONS
-LCD: Units with display
-BC: BACnet Communications
-MC: Modbus® Communications
-NIST: NIST traceable calibration certificate
-FC: Factory calibration certificate

ACCURACY AND PRESSURE RANGE
UNIDIRECTIONAL
101: 0.1 to 0.5 in w.c./25 to 125 pa/2.5 to 10 mm w.c.
102: 1 to 5 in w.c./250 to 1250 pa/25 to 125 mm w.c.

BIDIRECTIONAL
103*: ±10 to 28 in w.c./±2500 to 6975 pa/250 to 700 mm w.c.
111: ±0.1 to 0.5 in w.c./±25 to 125 pa/2.5 to 10 mm w.c.
112: ±1 to 5 in w.c./±250 to 1250 pa/±25 to 125 mm w.c.

ACCESSORIES

Model	Description
A-151	Cable gland for 5 to 10 mm diameter cable
A-MS2-LCD	Field upgradeable display
A-435-A	Remote display tool
A-480	Plastic static pressure tip
A-481	Installer kit; includes 2 plastic static pressure tips and 7 ft (2.1 m) of PVC tubing
A-489	4″ 303 SS straight static pressure tip with flange
A-302F-A	4″ 303 SS static pressure tip with mounting flange; for 3/16″ ID rubber or plastic tubing
SCD-PS	100 to 240 VAC/VDC to 24 VDC power supply

DWYER INSTRUMENTS, INC.
T: 219-879-8000 | F: 219-872-9057 | info@dwyermail.com
800-872-9141

SECTION 4.16

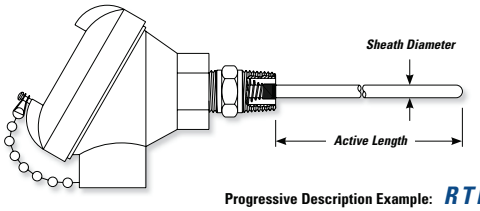
INLET TEMPERATURE TRANSMITTER

Lone Star Blower
8883 West Monroe
Houston, TX 77061

PH: 832-532-3112
FAX: 832-532-3115

TERMINAL HEAD AND SPRING LOADED MOUNTING ■ RTD ASSEMBLIES 500SB

Conax spring-loaded assemblies are used to maintain positive contact between the sensor tip and the surface to be monitored, typically used with thermowell assemblies. Conax supplies a number of styles of spring-loaded assemblies to meet application needs. Spring-loaded assemblies can be provided with all terminal heads. In addition, the T11SL model provides a spring-loaded assembly built into the T11 aluminum terminal head. This allows complete disassembly and removal of the sensor probe without dismantling the terminal head from the conduit or the vessel.
For detailed information on these mounting styles, see pages 40-41.



Progressive Description Example: ***RTD43W3-316SS25-T5AL(CSLW)-12.00"***

Sensor Element · 'W' Sensor Tolerance · '3' Sensor Lead Configuration · 0.250" 316 Stainless Steel Sheath · T5 Aluminum Termination · Mounting Style · Length

SS25 = .250" OD 304SST SHEATH

ERTD43

Specify Sensor Element

RTD43 Platinum
- 100Ω @ 0° C
- α = 0.00385 Ω/Ω/°C
- -200° C to +600° C
- -328° F to +1112° F

MRTDF43 Platinum
- 100Ω @ 0° C
- α = 0.00385 Ω/Ω/°C
- -50° C to +550° C
- -58° F to +1022° F

RTD44 Platinum
- 100Ω @ 0° C
- α = 0.00385 Ω/Ω/°C
- -200° C to +800° C
- -328° F to +1472° F
- Inconel 600 sheath standard

RTD45 Platinum
- 100Ω @ 0° C
- α = 0.003916 Ω/Ω/°C
- -200° C to +600° C
- -328° F to +1112° F

RTD86 Platinum
- 200Ω @ 0° C
- α = 0.00385 Ω/Ω/°C
- -200° C to +600° C
- -328° F to +1112° F

MRTDF430 Platinum
- 1000Ω @ 0° C
- α = 0.00385 Ω/Ω/°C
- -50° C to +550° C
- -58° F to +1022° F
- Available with 0.250" sheath diameter or larger

Note: For ASTM E1137 assemblies, use ordering prefix ARTD44W4-SS25 or ARTD44W4-INC25.

W

Specify Sensor Tolerance

W (Class B)
- Available for RTD43, 44 and 45, single and dual; and RTD86, MRTDF43 and MRTDF430, single only
- Tolerance at 0° C is ±0.3° C

V (1/3 Class B)
- Available for RTD43, 44 and 45 single only
- Tolerance at 0° C is ±0.1° C

S (Class A)
- Available for RTD43, 44 and 45 single only
- Tolerance at 0° C is ±0.15° C

X
- Available for ERTD41, single only; tolerance at 0° C is ±0.4° C
- Available for ERTD42, single; tolerance at 0° C is ±0.8° C
- Available for ERTD42, dual; tolerance at 0° C is ±1.4° C

ERTD41 Copper
- 10Ω (9.05Ω actual) @ 0° C
- α = 0.00426 Ω/Ω/°C
- -70° C to +150° C
- -94° F to +300° F
- Available with 0.250" sheath diameter or larger

ERTD42 Nickel
- 120Ω @ 0° C
- α = 0.00672 Ω/Ω/°C
- -40° C to +180° C
- -40° F to +350° F
- Available with 0.250" sheath diameter or larger

3

Specify Sensor Lead Configuration

2 — RED, WHITE — 2-WIRE SINGLE

3 — RED, RED, WHITE — 3-WIRE SINGLE

4 — RED, RED, WHITE, WHITE — 4-WIRE SINGLE

6 — RED, RED, WHITE, WHITE — 2-WIRE DUAL

7 — RED, RED, RED, WHITE, WHITE — 3-WIRE DUAL

8 — RED, RED, RED, RED, WHITE, WHITE, WHITE, WHITE — 4-WIRE DUAL

Note: 0.125" and 0.187" diameter sheaths can contain up to 4 wires; 0.250" diameter sheaths can contain up to 8 wires.

SS25

Specify Sheath Material & Size

316 Stainless Steel

316SS118
- 3 mm

316SS12
- 0.125" diameter

316SS18
- 0.187" diameter

316SS236
- 6 mm

316SS25
- 0.250" diameter

Inconel 600

INC12
- 0.125" diameter
- Standard sheath material for RTD44

INC18
- 0.187" diameter
- Standard sheath material for RTD44

INC25
- 0.250" diameter
- Standard sheath material for RTD44

Note: For additional diameters and other sheath materials, see page 7.

T5AL(5333A)

Specify Termination Style

T5AL - Aluminum
T5CI - Cast Iron
- NEMA 4 rated
- Conduit port 3/4 NPT

T5SS
- NEMA 4X rated
- 316 stainless steel construction
- Conduit port 3/4 NPT

T7
- Weather proof
- Aluminum conduit box accommodates up to 8 terminals
- Conduit port 3/4 NPT

T8E
- Explosion proof rating Class I, Group B, C & D Class II, Group E, F & G Class III
- Gray iron body with aluminum screw cover
- NEMA 4 rated
- Conduit port 1/2 NPT

T11
- Weather proof
- Aluminum construction
- Conduit port 1/2 NPT

T11PL
- Weather proof
- Plastic construction
- Conduit port 1/2 NPSM

T12
- Weather proof
- Aluminum construction
- Flip-top head
- Conduit port 1/2 NPT

T13T
- FDA compliant, NEMA 4X rated
- White, unpigmented polypropylene construction
- 4 terminal posts
- Conduit port 3/4 NPT

T15EAL - Aluminum
T15ESS - Stainless Steel
T15EAL(ATEX)
- Explosion Proof rating Class 1, Division 1, Groups B, C and D and Dust Proof/Ignition Proof rating for Class II, Division 1, Group E, F & G
- Ratings: T15EAL – NEMA 4, T15ESS – NEMA 4X
- Conduit port 3/4 NPT

Note: For additional terminal head types and detailed descriptions, see pages 43-47.

(CSLW)

Specify Mounting Style

CSLW
- For 0.125", 0.187" and 0.250" diameter sheaths
- Stainless steel construction
- Mounting thread 1/2 NPT

SLAN
- For 0.125", 0.187" and 0.250" diameter sheaths
- Stainless steel construction
- Mounting thread 1/2 NPT
- Probe position can be adjusted in the field

SLANS
- For 0.250" diameter sheath
- Includes Viton O-ring
- Stainless steel construction

6.00"

Specify Length in Inches (required)

SLN
- For 0.125", 0.187" and 0.250" diameter sheath
- Mounting thread 1/2 NPT
- Most durable

SL
- Spring-loaded packing gland
- Spring travel: 1/4" to 3/8"
- 2-8 pounds spring pressure
- Stainless steel construction, Teflon sealant
- Available with B cap for direct mount
- *Additional dimensional data required, see page 40.*

SL12
- For 0.125" diameter sheath
- Mounting thread 1/8 NPT

SL18
- For 0.187" diameter sheath
- Mounting thread 1/4 NPT

SL25
- For 0.250" diameter sheath
- Mounting thread 1/2 NPT
- Optional 1/4 NPT mounting thread is available. Consult factory.

For additional information on spring-loaded mounting styles, see pages 40-41.

ERTD43W3-SS25-T5AL5333A(CSLW)-.50-260S-U6.00-S316(0/350F)

CSLW = SPRING LOADED FITTING FOR USE WITH THERMOWELL.

THERMOWELL HAS A .50 NPT MOUNTING THREAD AND U=6.00"

✆ Tel: 1.716.684.4500 • USA: 1.800.223.2389 • Website: www.conaxtechnologies.com Conax TECHNOLOGIES

2-Wire Programmable Transmitter
Model 5333A

- **RTD or Ohm Input**
- **High Measurement Accuracy**
- **3-Wire Connection**
- **Programmable Sensor Error Value**

Application:

- Linearized temperature measurement with Pt100... Pt1000 or Ni100...Ni1000 sensor.
- Conversion of linear resistance variation to a standard analog current signal.

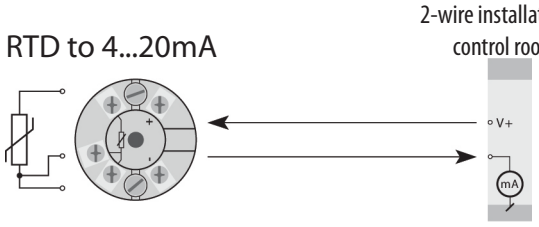
Technical Characteristics:

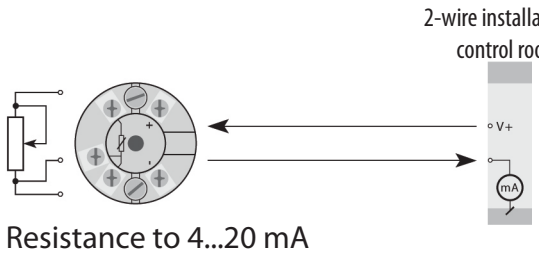
- Within seconds the user can program a 5333A to measure temperatures within all standard RTD sensor ranges.
- The RTD and resistance inputs have cable compensation for 3-wire connections.

Mounting / Installation:

- DIN Form B sensor head compatible.
- Supplied with 2 x M4 screws on a 33 mm(1.3") BC (optional 6-32 screws available).

RTD to 4...20mA





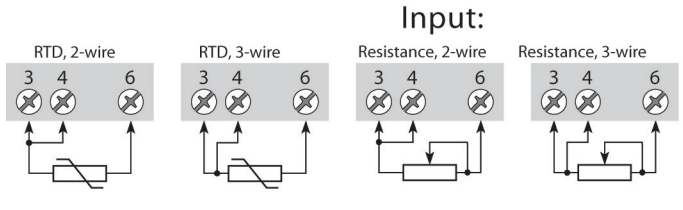
Resistance to 4...20 mA

Tel: **1.716.684.4500** • USA Toll Free: **1.800.223.2389** • Email: **sales@conaxtechnologies.com** • Website: **www.conaxtechnologies.com**

Specifications

Order: 5333A

Connections:



Electrical Specifications:
Specifications Range: -40°C to +85°C
Common Specifications:
Supply voltage, DC ..... 8.0...35 V
Internal consumption ..... 25 mW...0.8 W
Voltage drop ..... 8 VDC
Warm-up time ..... 5 min.
Communications interface ..... Loop Link
Signal / noise ratio ..... Min. 60 dB
Response time (programmable) ..... 0.33...60s
Signal dynamics, input ..... 19 bit
Signal dynamics, output ..... 16 bit
Calibration temperature ..... 20...28°C
Accuracy, the greater of general and basic values:

General Values		
Input Type	Absolute Accuracy	Temperature Coefficient
All	≤ ±0.1% of span	≤ ±0.01% of span / °C

Basic Values		
Input Type	Basic Accuracy	Temperature Coefficient
RTD	≤ ±0.3°C	≤ ±0.01°C/ °C
Lin. R	≤ ±0.2 Ω	≤ ±20 mΩ/°C

EMC immunity influence ..... ≤ ±0.5% of span

Effect of supply voltage variation..... ≤ 0.005% of span / VDC
Vibration ..... IEC 60068-2-6 Test FC
Lloyd's specification no. 1 ..... 4 g / 2...100 Hz
Max wire size ..... 1 x 1.5mm^2(16 AWG) stranded wire
Humidity ..... < 95% RH (non-cond.)
Dimensions ..... Ø 44 x 20.2 mm
Protection degree (encl. / terminal) ... IP68 / IP00
Weight..... 50 g

Electrical Specifications, Input:
RTD and Linear Resistance Input:

RTD Type	Min. Value	Max. Value	Min. Span	Standard
Pt100	-200°C	+850°C	25°C	IEC 60751
Ni100	-60°C	+250°C	25°C	DIN 43760
Lin. R	0 Ω	10000 Ω	30 Ω	------

Max. offset ..... 50% of selected max. value
Cable resistance per wire (max.) ..... 10 Ω
Sensor current ..... > 0.2 mA, < 0.4 mA
Effect of sensor cable resistance
(3-wire) ..... < 0.002 Ω / Ω
Sensor error detection ..... Yes
Output:
Current Output:
Signal range ..... 4...20 mA
Min. signal range ..... 16 mA
Updating time ..... 135 ms
Load resistance ..... ≤ (Vsupply- 8) / 0.023 [Ω]
Load stability ..... < ±0.01% of span/100 Ω
Sensor Error Detection:
Programmable ..... 3.5...23 mA
NAMUR NE43 Upscale ..... 23 mA
NAMUR NE43 Downscale ..... 3.5 mA
Marine Approval:
Det Norske Veritas, Ships & Offshore ..... Standard for Certific. No. 2.4
Observed Authority Requirements: **Standard:**
EMC 2004/108/EC
Emission and immunity ..... EN 61326

Of span = Of the presently selected range
Loop Link = PC compatible programming software.

Request catalog 5005, our RTD & Thermocouple Assemblies Resource Guide

Visit www.conaxtechnologies.com for technical data on temperature sensors, thermocouples, RTDs, thermowells, transmitters, special assemblies and more.

Conax TECHNOLOGIES®

ISO 9001:2008 SGS

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Toll free in the USA at 1-800-223-2389
E-mail: sales@conaxtechnologies.com
Website: www.conaxtechnologies.com

SECTION 4.17

INLET VACUUM GAUGE

Lone Star Blower
8883 West Monroe
Houston, TX 77061

PH: 832-532-3112
FAX: 832-532-3115

ASHCROFT®
Trust the shield.®

1188 Low Pressure Bellows Gauge

FEATURES

- Inches of water ranges from 5IW
- Bellows-actuated mechanism
- Easy adjustable micrometer pointer
- Available with diaphragm seals

TYPICAL USES

- Oil & gas
- Chemical and petrochemical plants
- Water and wastewater pressure control
- Equipment skids
- Process and industrial applications

1188
4½″ dial size

SPECIFICATIONS

Accuracy:	+/-2%-1%-2% (ASME B40.100 Grade A)
Dial Size:	4½″
Range:	10IW Vacuum to 10 psi
Process Connection Location:	Lower, Back
Process Connection Size:	¼ NPT Male, ½ NPT Male
Case Style:	Solid Front (STD.)
Movement:	416 Stainless steel
Window Material:	Glass (STD.), Shatter Proof Glass (OPT.)
Pointer:	Micrometer Adjustable
Dampening Options:	Throttle screw, dampeners, capillary, diaphragm seals and snubbers
Mounting:	Stem, Surface, Flush

WETTED COMPONENTS

Bellows	Process Connection	Joints
Brass 316 SS Monel®	Brass 316 SS Monel®	Soldered: Brass Welded: 316 SS Monel®

NON-WETTED COMPONENTS

Case	Ring	Back Cover
Phenolic	Polycarbonate	Polypropylene

KEY BENEFITS

- **A variety of wetted parts compatable with many process medias**
- **Ideal product solution for many installations**
- **Available with panel mount design**
- **Overpressure capability up to 5x full scale range standard**

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1.800.328.8258

ASHCROFT®
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1188 Low Pressure Bellows Gauge

45-1188-S-S-04-L-N10IW

ORDERING CODE Example:	451188	S	S	02	B	XC4	10IW
Dial Size/Model Code							
451188 - 4½″ phenolic case, solid front	451188						
System (tube and process connection)							
A - Brass bellows, brass process connection							
S - 316 Stainless steel bellows, stainless steel process connection		S					
P - K-Monel® 500 bellows, Monel® 400 process connection							
Case Design							
S - Solid front, Dry			S				
Process Connection Sizes							
02 - ¼ NPT Male				02			
04 - ½ NPT Male							
Process Connection Location							
L - Lower							
B - Back					B		
Options (If choosing an option(s) must include an "X")						X_ _	
C4 - Individual calibration chart (in accordance with ASME B40.100:2013. Accuracy traceable to N.I.S.T)						C4	
D3 - DuraVis™ Retroreflective Dial							
6B - Cleaned for gaseous oxygen service							
F8 - Gauge, flexible line assembly and diaphragm seal							
PD - Acrylic window							
SG - Safety glass							
NG - Non-glare glass							
DA - Marking on dial							
NH - Stainless Steel tag wired to case							
NN - Paper tag bonded to case							
56 - Flush mounting ring							
Range (coding examples only, see range table on page 3 for all standard ranges)							
Single Scales							
10IW - 10″ H_2O							10IW

When selecting a diaphragm seal or isolation ring, refer to the Min/Max Guide for compatibility with this gauge or scan the QR code to the right.

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1188 Low Pressure Bellows Gauge

STANDARD PRESSURE RANGE

	in. H_2O	mmHg	in. Hg	mmH_2O	psi	mbar	kPa
Vacuum	N10IW	N18MM	-	-	-	-	-
	N15IW	N28MM	-	-	-	-	-
	N20IW	N37MM	-	-	-	-	-
	N30IW	N56MM	-	-	-	-	-
	N40IW	N75MM	-	-	-	-	-
	N60IW	N110MM	-	-	-	-	-
	N80IW	N150MM	-	-	-	-	-
	N100IW	N180MM	-	-	-	-	-
	N150IW	N270MM	-	-	-	-	-
	-	-	N10IM	-	-	-	-
	-	-	N15IM	-	-	-	-
	-	-	N20IM	-	-	-	-
Compound	-	-	-	N125/125MW	-	N12.5/12.5MB	N1.25/1.25KP
	N5/5IW	-	-	-	-	-	-
	-	-	-	N200/200MW	-	N20/20MB	N2/2KP
	N10/10IW	-	-	-	-	-	-
	-	-	-	N300/300MW	-	N30/30MB	N3/3KP
	-	-	-	N500/500MW	-	N50/50MB	N5/5KP
	N30/10IW	-	-	-	-	-	-
	N20/20IW	-	-	-	-	-	-
	N10/30IW	-	-	-	-	-	-
	N30/30IW	-	-	-	-	-	-
	N40/20IW	-	-	N800/800MW	-	N80/80MB	N8/8KP
	-	-	-	N1250/1250MW	-	N125/125MB	N12.5/12.5KP
	N70/30IW	-	-	-	-	-	-
	-	-	-	N2000/2000MW	-	N200/200MB	N20/20KP
	-	-	-	N3000/3000MW	-	N300/300MB	N30/30KP
Positive Pressure	5IW	-	-	-	-	-	-
	10IW		-	250MW		25MB	2.5KP
	15IW	-	-	-	-	-	-
	-	-	-	400MW	-	-	-
	-	-	-	-	-	40MB	4KP
	20IW	-	-	-	-	-	-
			-	600MW	-	-	-
	-	-	-	-	-	60MB	6KP
	30IW	-	-	-	-	-	-
	-	-	-	1000MW	-	-	-
	40IW	-	-	-	-	100MB	10KP
		-	-	-	-		
	60IW	-	-	-	-	-	-
	-	-	-	1600MW	-	-	-
	-	-	-	-	-	160MB	16KP
	80IW	-	-	-	-	-	-
	-	-	-	2500MW	-	-	-
	100IW	-	-	-	-	250MB	25KP
	-	-	-	-	5#	-	-
	150IW	-	-	-	-	-	-
	-	-	-	4000MW	-	-	-
	-	-	-	-	-	400MB	40KP
	-	-	-	-	8#	-	-
	-	-	-	6000MW	-	-	-
	-	-	-	-	-	600MB	60KP
	-	-	-	-	10#	-	-

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1188 Low Pressure Bellows Gauge

LOW PRESSURE BELLOWS GAUGES OVERPRESSURE & VACUUM TABLE

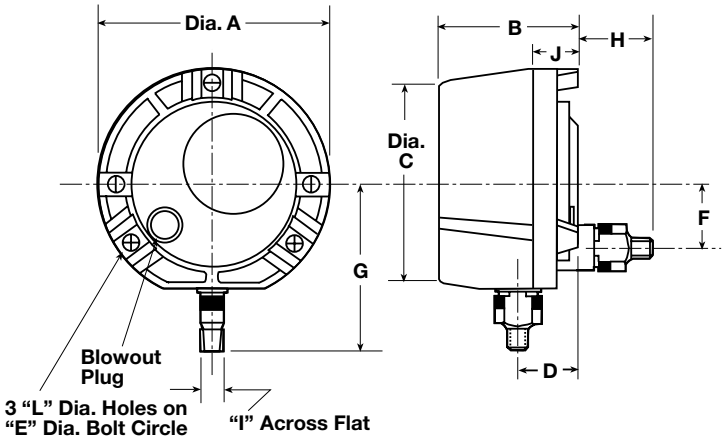
Burst pressure for all bellows is 100 psi.
The table shown below indicates the over pressure protection built into the bellows actuated low pressure gauges based on the pressure range selected.
(Please refer to PI Page: IG-PI-01A for vacuum and compound range)

Dial Arc	Pressure Ranges	Proof Pressure	Vacuum Protection
180°	10˝ Water	50˝ Water	50˝ Water
180°	15˝ Water	75˝ Water	75˝ Water
180°	20˝ Water	100˝ Water	100˝ Water
216°	30˝ Water	150˝ Water	150˝ Water
270°	40˝ Water	200˝ Water	200˝ Water
270°	60˝ Water	300˝ Water	300˝ Water
270°	80˝ Water	400˝ Water	400˝ Water
270°	100˝ Water	500˝ Water	406˝ Water
270°	150˝ Water	750˝ Water	406˝ Water
270°	5 psi	26 psi	14.7 psi
270°	8 psi	30 psi	14.7 psi
270°	10 psi	30 psi	14.7 psi

DIMENSIONS in [ ] are millimeters

For reference only, consult Ashcroft for specific dimensional drawings

Dial Size Inches	A	B	C	D	E	F	G	H	I	J	L	Weight (lbs)
4½	5 13/16 [148]	3 7/16 [87]	5 1/16 [129]	1 11/16 [43]	5 3/8 [137]	1 5/8 [41]	13 15/16 [100]	1 1/2 [38]	5/8 [16]	1 1/8 [29]	7/32 [5.5]	2.5 1.1 kg



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SECTION 4.18

DISCHARGE PRESSURE GAUGE

Lone Star Blower
8883 West Monroe
Houston, TX 77061

PH: 832-532-3112
FAX: 832-532-3115

ASHCROFT®
Trust the shield.®

1279 Duragauge® Pressure Gauge

FEATURES

- Custom dial printing options
- Micrometer adjustable pointer
- ***PLUS***™ Performance option dampens vibration, shock and pulsation effects
- Pressure range from Vacuum to 30,000 psi

TYPICAL USES

- Refineries
- Chemical and petrochemical plants
- Offshore oil rigs
- Water and wastewater pressure control
- Pulp and water
- Mining and metals
- Equipment skids
- Specialized OEM equipment
- Cryogenics

1279
4½″ dial size

SPECIFICATIONS

Accuracy:	±0.5% of span (ASME B40.100 Grade 2A)
Size:	4½″
Range:	Vacuum, Compound to 30,000 psi
Process Connection Location:	Lower, back, side, top
Process Connection:	¼ NPT Male, ½ NPT Male, 9/16-18 UNF-2B (high pressure connection)
Case Style:	Solid front with pressure relief back
Window:	Glass (STD.), acrylic, shatter proof glass, non-glare glass (OPT.)
Movement:	Rotary, adjustable, 400 SS, Teflon® coated
Movement Materials:	400 SS, Teflon® coated pinion gear and segment
Dial:	Aluminum, white background, black scale
Pointer:	Micrometer, adjustable, aluminum
Weather Protection:	Dry case: Case not sealed, recommended for weather protected environment only Liquid filled or field fillable: IP66 or NEMA 4X (S&P tube and socket), NEMA 4 (A&R tube and socket Hermetically sealed: IP66
Dampening Options:	Liquid: glycerin, silicone, Halocarbon®, ***PLUS!***™ Performance
Mounting:	Stem, surface (STD.), flush, pipe, remote (OPT.)
Approvals:	CRN

WETTED COMPONENTS

Bourdon Tube	Process Connection Materials	Joints
316L SS	316L SS	Welded
316L SS	Steel	Welded
K-Monel® 500 Tube	Monel® 400	Welded
C510 Phos. Bronze	Brass	Silver brazed

KEY BENEFITS

- **Available with a wide variety of accessory and diaphragm seal assemblies**
- **Available with high process temperature dissipation siphons**

MIN/MAX TEMPERATURE LIMITS

Version	Ambient	Process	Storage
Dry	-20°F to 200°F (-29°C to 93°C)	-20°F to 250°F (-29°C to 121°C)	-40°F to 250°F (-40°C to 121°C)
PLUS!™	-40°F to 150°F (-40°C to 66°C)	-40°F to 200°F (-40°C to 93°C)	-40°F to 150°F (-40°C to 66°C)
Glycerin fill	20°F to 150°F (-7°C to 66°C)	20°F to 150°F (-7°C to 66°C)	0°F to 150°F (-18°C to 66°C)
Silicone fill	-40°F to 150°F (-40°C to 66°C)	-40°F to 200°F (-40°C to 93°C)	-40°F to 150°F (-40°C to 66°C)
Halocarbon® fill	-40°F to 150°F (-40°C to 66°C)	-40°F to 200°F (-40°C to 93°C)	-40°F to 150°F (-40°C to 66°C)

NON-WETTED COMPONENTS

Case	Ring	Pressure Relief Back
Phenolic	Threaded, Polycarbonate (Meets UL 94 V-0)	Polycarbonate (Meets UL 94 V-0)

Note: Other than discoloration of the dial and hardening of the gasketing that may occur as ambient or process temperatures exceeds 150°F, non-liquid-filled gauges with standard glass windows, can withstand continuous operating temperatures up to 250°F (121°C). Liquid-filled gauges can withstand 200°F (93°C) but glycerin fill and acrylic window will tend to yellow. Accuracy at temperatures above or below the reference ambient temperature of 68°F (20°C) will be affected by approximately 0.4% per 25°F. Gauges with welded joints will withstand 750°F (400°C), 450°F (232°C) with silver brazed joints for short times without rupture, although other parts of the gauge will be destroyed and calibration will be lost. For continuous use and for process or ambient temperatures above 250°F (121°C), a diaphragm seal or capillary or siphon is recommended.

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1279 Duragauge® Pressure Gauge

45-1279-R-S-04-L-20#

ORDERING CODE Example:	451279	S	SH	04	L	XLL	15#
Dial Size/Model Code							
451279 - 4½″ solid front	451279						
System (tube and process connection)							
A - Bronze tube, brass process connection, Max. pressure connection 1,000 psi							
P - K-Monel® 500 tube, Monel® 400 process connection, Max. pressure 30,000 psi							
R - 316L SS tube, steel process connection, Max. pressure 30,000 psi							
S - 316 SS tube, 316L SS process connection, Max. pressure 30,000 psi		S					
Case Design							
S - Solid front case, dry							
SH - Solid front case, dry, hermetically sealed			SH				
SL - Solid front case, liquid filled (glycerin STD.)							
Process Connection Sizes							
02 - ¼ NPT Male, N/A for ranges over 20,000 psi							
04 - ½ NPT Male, N/A for ranges over 20,000 psi				04			
09 - 9/16-18 UNF-2B, high pressure fitting, pressures over 20,000 psi (STD.)							
AM - AND 10050-4 (¼ tubing connection)							
RW - SAE 7/16-20 Straight thread							
Process Connection Location							
L - Lower					L		
B - Back							
D - Side (3 o'clock)							
E - Side connection (9 o'clock)							
T - Top connection							
Options (If choosing an option(s) must include a "X") (See Table 1 on page 5 for more options)						X__	
GV - Silicone case fill							
GX - Halocarbon® case fill							
LL - ***PLUS!***™ Performance						LL	
NZ - ***PLUS!***™ Performance, silicone free							
NH - Stainless Steel tag wired to case							
PD - Acrylic window (STD. with liquid filled or hermetically sealed cases)							
C4 - Individual calibration chart (in accordance with ASME B40.100:2013. Accuracy traceable to NIST)							
6B - Cleaned for oxygen service							
Range (coding examples only, see range table on page 3 for all standard ranges)							
Single Scales							
15# - 15 psi							15#
1BR - 1 bar							
1KG - 1 kg/cm²							
100KP - 100 kPa							
Dual Scales							
15#/BR - 15 psi inner scale, 1 bar outer scale							
1BR/# - 1 bar inner scale, 15 psi outer scale							

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1279 Duragauge® Pressure Gauge

STANDARD PRESSURE RANGES

	psi	bar	kPa	mPa	kg/cm²
Vacuum	30IMV	N1BR	N100KP	N1MP	N1KG
	–	N1/0.6BR	N100/60KP	0.1/0.06MP	N1/0.6KG
Compound	V/15#	–	–	–	–
	–	N1/1.5BR	N100/150KP	N0.1/0.15MP	N1/1.5KG
	V/30#	–	–	–	–
	–	N1/3BR	N100/300KP	N0.1/0.3MP	N1/3KG
	V/60#	–	–	–	–
	–	N1/5BR	N100/500KP	N0.1/0.5MP	N1/5KG
	V/100#	–	–	–	–
	–	N1/9BR	N100/900KP	N0.1/0.9MP	N1/9KG
Positive Pressure	15#	1BR	100KP	0.1MP	1KG
	20#	–	–	–	–
	–	1.6BR	160KP	0.16MP	1.6KG
	30#	–	–	–	–
	–	2.5BR	250KP	0.25MP	2.5KG
	60#	4BR	400KP	0.4MP	4KG
	–	6BR	600KP	0.6MP	6KG
	100#	–	–	–	–
	120#	–	–	–	–
	–	10BR	1000KP	1MP	10KG
	160#	–	–	–	–
	200#	–	–	–	–
	–	16BR	1600KP	1.6MP	16KG
	300#	–	–	–	–
	–	25BR	2500KP	2.5MP	25KG
	400#	–	–	–	–
	500#	–	–	–	–
	600#	40BR	4000KP	4MP	40KG
	800#	–	–	–	–
	–	60BR	6000KP	6MP	60KG
	1000#	–	–	–	–
	1500#	100BR	10000KP	10MP	100KG
	2000#	–	–	–	–
	–	160BR	16000KP	16MP	160KG
	3000#	–	–	–	–
	–	250BR	25000KP	25MP	250KG
	4000#	–	–	–	–
	5000#	–	–	–	–
	6000#	400BR	40000KP	40MP	400KG
	8000#	–	–	–	–
	–	600BR	60000KP	60MP	600KG
	10000#	–	–	–	–
	15000#	1000BR	100000KP	100MP	1000KG
	20000#	-	-	-	-
	-	1600BR	-	160MP	1600KG
	30000#	-	-	-	-
		2500BR	-	250MP	2500KG

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info@ashcroft.com
1.800.328.8258

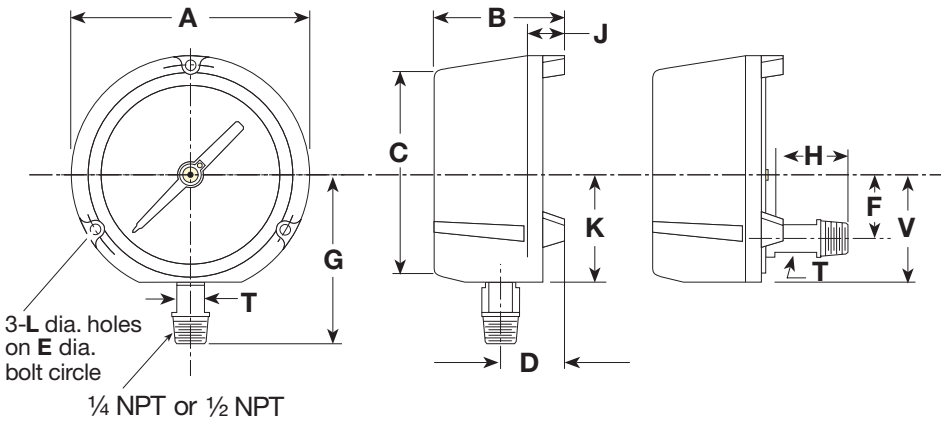
ASHCROFT®
Trust the shield.®

1279 Duragauge® Pressure Gauge

DIMENSIONS in [ ] are millimeters

For reference only, consult Ashcroft for specific dimensional drawings

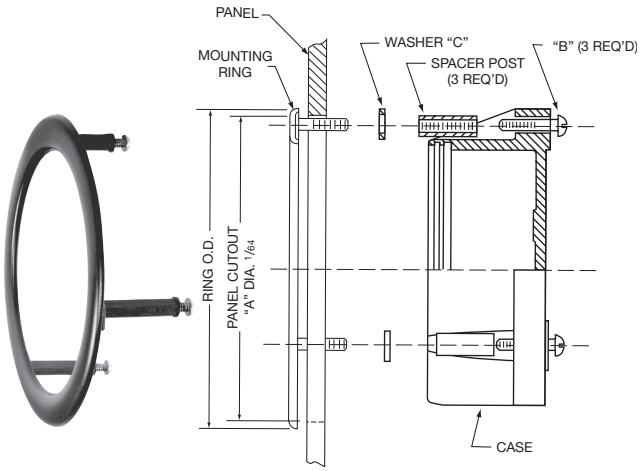
Dial Size Inches	A	B	C	D	E	F	G	H	J	K	T	V	Weight (lbs)
4½	5.81 [147.6]	3.36 [85.3]	5.07 [128.7]	1.06 [40.6]	5.375 [137]	1.62 [41.2]	3.92 [99.6]	0.73 [18.4]	0.22 [5.5]	2.62 [66.7]	0.94 [23.9]	2.625 [67]	2.5 (Dry) 3.5 (L.F.)



1278M Series Flush Mounting Ring

1278M Series Flush Mounting Ring. Used to flush mount gauge case 1279(*)S. Black finish (STD.); Polished SS finish (OPT.)

Gauge Size Inches	Ring O.D.	"A" DIA.	"B" Size of 3 Screws	"C" Size of Washers
4½	6 [152]	5.625 [148]	#10-24 x 1⅝	7/16 x 17/64 x 5/8



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1279 Duragauge® Pressure Gauge

TABLE 1 - OPTIONS	
CODE	**OPTION**
AB	Gauges calibrated to compensate for absolute pressure
DA	Dial marking (text marking on the dial)
EP	Maximum pointer (adjustable, N/A with liquid filled or hermetically sealed cases)
GV	Silicone case fill
GX	Halocarbon® case fill
HY	Hydrostatic/pneumatic testing (system pressurized to 150% of rated system pressure for 5 minutes. Overload stop STD.)
NG	Non-glare glass (N/A with liquid fill or hermetically sealed cases)
NH	SS tag wired to case
OS	Overload stop
PD	Acrylic window (STD. with liquid filled or hermetically sealed cases)
SH	Red set hand, stationary
SG	Safety glass
TS	Throttle screw (STD. with liquid filled, hermetically sealed or ***PLUS!***™ Performance)
VS	Underload stop
C4	Individual calibration chart (in accordance with ASME B40.100:2013. Accuracy traceable to NIST)
6B	Cleaned for oxygen service
56	Flush mounting ring

ashcroft.com
info@ashcroft.com
1.800.328.8258

SECTION 4.19

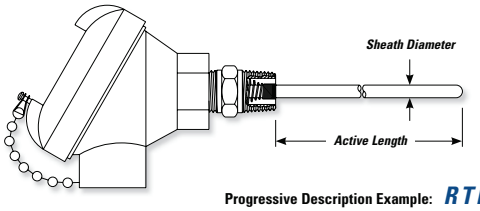
DISCHARGE TEMPERATURE TRANSMITTER

Lone Star Blower
8883 West Monroe
Houston, TX 77061

PH: 832-532-3112
FAX: 832-532-3115

TERMINAL HEAD AND SPRING LOADED MOUNTING ■ RTD ASSEMBLIES
500SB

Conax spring-loaded assemblies are used to maintain positive contact between the sensor tip and the surface to be monitored, typically used with thermowell assemblies. Conax supplies a number of styles of spring-loaded assemblies to meet application needs. Spring-loaded assemblies can be provided with all terminal heads. In addition, the T11SL model provides a spring-loaded assembly built into the T11 aluminum terminal head. This allows complete disassembly and removal of the sensor probe without dismantling the terminal head from the conduit or the vessel.
For detailed information on these mounting styles, see pages 40-41.



Progressive Description Example: ***RTD43W3-316SS25-T5AL(CSLW)-12.00"***

Sensor Element · 'W' Sensor Tolerance · '3' Sensor Lead Configuration · 0.250" 316 Stainless Steel Sheath · T5 Aluminum Termination · Mounting Style · Length

SS25 = .250" OD 304SST SHEATH

ERTD43

Specify Sensor Element

RTD43 Platinum
- 100Ω @ 0° C
- α = 0.00385 Ω/Ω/°C
- -200° C to +600° C
- -328° F to +1112° F

MRTDF43 Platinum
- 100Ω @ 0° C
- α = 0.00385 Ω/Ω/°C
- -50° C to +550° C
- -58° F to +1022° F

RTD44 Platinum
- 100Ω @ 0° C
- α = 0.00385 Ω/Ω/°C
- -200° C to +800° C
- -328° F to +1472° F
- Inconel 600 sheath standard

RTD45 Platinum
- 100Ω @ 0° C
- α = 0.003916 Ω/Ω/°C
- -200° C to +600° C
- -328° F to +1112° F

RTD86 Platinum
- 200Ω @ 0° C
- α = 0.00385 Ω/Ω/°C
- -200° C to +600° C
- -328° F to +1112° F

MRTDF430 Platinum
- 1000Ω @ 0° C
- α = 0.00385 Ω/Ω/°C
- -50° C to +550° C
- -58° F to +1022° F
- Available with 0.250" sheath diameter or larger

Note: For ASTM E1137 assemblies, use ordering prefix ARTD44W4-SS25 or ARTD44W4-INC25.

W

Specify Sensor Tolerance

W (Class B)
- Available for RTD43, 44 and 45, single and dual; and RTD86, MRTDF43 and MRTDF430, single only
- Tolerance at 0° C is ±0.3° C

V (1/3 Class B)
- Available for RTD43, 44 and 45 single only
- Tolerance at 0° C is ±0.1° C

S (Class A)
- Available for RTD43, 44 and 45 single only
- Tolerance at 0° C is ±0.15° C

X
- Available for ERTD41, single only; tolerance at 0° C is ±0.4° C
- Available for ERTD42, single; tolerance at 0° C is ±0.8° C
- Available for ERTD42, dual; tolerance at 0° C is ±1.4° C

ERTD41 Copper
- 10Ω (9.05Ω actual) @ 0° C
- α = 0.00426 Ω/Ω/°C
- -70° C to +150° C
- -94° F to +300° F
- Available with 0.250" sheath diameter or larger

ERTD42 Nickel
- 120Ω @ 0° C
- α = 0.00672 Ω/Ω/°C
- -40° C to +180° C
- -40° F to +350° F
- Available with 0.250" sheath diameter or larger

3

Specify Sensor Lead Configuration

2 — RED, WHITE — 2-WIRE SINGLE

3 — RED, RED, WHITE — 3-WIRE SINGLE

4 — RED, RED, WHITE, WHITE — 4-WIRE SINGLE

6 — RED, RED, WHITE, WHITE — 2-WIRE DUAL

7 — RED, RED, RED, WHITE, WHITE — 3-WIRE DUAL

8 — RED, RED, RED, RED, WHITE, WHITE, WHITE, WHITE — 4-WIRE DUAL

Note: 0.125" and 0.187" diameter sheaths can contain up to 4 wires; 0.250" diameter sheaths can contain up to 8 wires.

SS25

Specify Sheath Material & Size

316 Stainless Steel

316SS118
- 3 mm

316SS12
- 0.125" diameter

316SS18
- 0.187" diameter

316SS236
- 6 mm

316SS25
- 0.250" diameter

Inconel 600

INC12
- 0.125" diameter
- Standard sheath material for RTD44

INC18
- 0.187" diameter
- Standard sheath material for RTD44

INC25
- 0.250" diameter
- Standard sheath material for RTD44

Note: For additional diameters and other sheath materials, see page 7.

T5AL(5333A)

Specify Termination Style

T5AL - Aluminum
T5CI - Cast Iron
- NEMA 4 rated
- Conduit port 3/4 NPT

T5SS
- NEMA 4X rated
- 316 stainless steel construction
- Conduit port 3/4 NPT

T7
- Weather proof
- Aluminum conduit box accommodates up to 8 terminals
- Conduit port 3/4 NPT

T8E
- Explosion proof rating Class I, Group B, C & D Class II, Group E, F & G Class III
- Gray iron body with aluminum screw cover
- NEMA 4 rated
- Conduit port 1/2 NPT

T11
- Weather proof
- Aluminum construction
- Conduit port 1/2 NPT

T11PL
- Weather proof
- Plastic construction
- Conduit port 1/2 NPSM

T12
- Weather proof
- Aluminum construction
- Flip-top head
- Conduit port 1/2 NPT

T13T
- FDA compliant, NEMA 4X rated
- White, unpigmented polypropylene construction
- 4 terminal posts
- Conduit port 3/4 NPT

T15EAL - Aluminum
T15ESS - Stainless Steel
T15EAL(ATEX)
- Explosion Proof rating Class 1, Division 1, Groups B, C and D and Dust Proof/Ignition Proof rating for Class II, Division 1, Group E, F & G
- Ratings: T15EAL – NEMA 4, T15ESS – NEMA 4X
- Conduit port 3/4 NPT

Note: For additional terminal head types and detailed descriptions, see pages 43-47.

(CSLW)

Specify Mounting Style

CSLW
- For 0.125", 0.187" and 0.250" diameter sheaths
- Stainless steel construction
- Mounting thread 1/2 NPT

SLAN
- For 0.125", 0.187" and 0.250" diameter sheaths
- Stainless steel construction
- Mounting thread 1/2 NPT
- Probe position can be adjusted in the field

SLANS
- For 0.250" diameter sheath
- Includes Viton O-ring
- Stainless steel construction

6.00"

Specify Length in Inches (required)

SLN
- For 0.125", 0.187" and 0.250" diameter sheath
- Mounting thread 1/2 NPT
- Most durable

SL
- Spring-loaded packing gland
- Spring travel: 1/4" to 3/8"
- 2-8 pounds spring pressure
- Stainless steel construction, Teflon sealant
- Available with B cap for direct mount
- *Additional dimensional data required, see page 40.*

SL12
- For 0.125" diameter sheath
- Mounting thread 1/8 NPT

SL18
- For 0.187" diameter sheath
- Mounting thread 1/4 NPT

SL25
- For 0.250" diameter sheath
- Mounting thread 1/2 NPT
- Optional 1/4 NPT mounting thread is available. Consult factory.

For additional information on spring-loaded mounting styles, see pages 40-41.

ERTD43W3-SS25-T5AL5333A(CSLW)-.50-260S-U6.00-S316(0/350F)

CSLW = SPRING LOADED FITTING FOR USE WITH THERMOWELL.

THERMOWELL HAS A .50 NPT MOUNTING THREAD AND U=6.00"

✆ Tel: 1.716.684.4500 • USA: 1.800.223.2389 • Website: www.conaxtechnologies.com
Conax TECHNOLOGIES

2-Wire Programmable Transmitter
Model 5333A

- **RTD or Ohm Input**
- **High Measurement Accuracy**
- **3-Wire Connection**
- **Programmable Sensor Error Value**

Application:

- Linearized temperature measurement with Pt100... Pt1000 or Ni100...Ni1000 sensor.
- Conversion of linear resistance variation to a standard analog current signal.

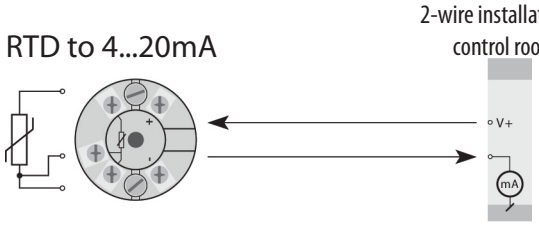
Technical Characteristics:

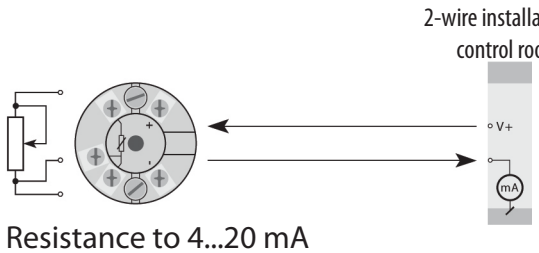
- Within seconds the user can program a 5333A to measure temperatures within all standard RTD sensor ranges.
- The RTD and resistance inputs have cable compensation for 3-wire connections.

Mounting / Installation:

- DIN Form B sensor head compatible.
- Supplied with 2 x M4 screws on a 33 mm(1.3") BC (optional 6-32 screws available).

RTD to 4...20mA





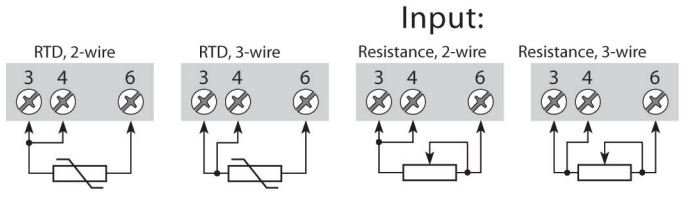
Resistance to 4...20 mA

Tel: **1.716.684.4500** • USA Toll Free: **1.800.223.2389** • Email: **sales@conaxtechnologies.com** • Website: **www.conaxtechnologies.com**

Specifications

Order: 5333A

Connections:



Electrical Specifications:
Specifications Range: -40°C to +85°C
Common Specifications:
Supply voltage, DC ..... 8.0...35 V
Internal consumption ..... 25 mW...0.8 W
Voltage drop ..... 8 VDC
Warm-up time ..... 5 min.
Communications interface ..... Loop Link
Signal / noise ratio ..... Min. 60 dB
Response time (programmable) ..... 0.33...60s
Signal dynamics, input ..... 19 bit
Signal dynamics, output ..... 16 bit
Calibration temperature ..... 20...28°C
Accuracy, the greater of general and basic values:

General Values		
Input Type	Absolute Accuracy	Temperature Coefficient
All	≤ ±0.1% of span	≤ ±0.01% of span / °C

Basic Values		
Input Type	Basic Accuracy	Temperature Coefficient
RTD	≤ ±0.3°C	≤ ±0.01°C/ °C
Lin. R	≤ ±0.2 Ω	≤ ±20 mΩ/°C

EMC immunity influence ..... ≤ ±0.5% of span

Effect of supply voltage variation..... ≤ 0.005% of span / VDC
Vibration ..... IEC 60068-2-6 Test FC
Lloyd's specification no. 1 ..... 4 g / 2...100 Hz
Max wire size ..... 1 x 1.5mm^2(16 AWG) stranded wire
Humidity ..... < 95% RH (non-cond.)
Dimensions ..... Ø 44 x 20.2 mm
Protection degree (encl. / terminal) ... IP68 / IP00
Weight..... 50 g

Electrical Specifications, Input:
RTD and Linear Resistance Input:

RTD Type	Min. Value	Max. Value	Min. Span	Standard
Pt100	-200°C	+850°C	25°C	IEC 60751
Ni100	-60°C	+250°C	25°C	DIN 43760
Lin. R	0 Ω	10000 Ω	30 Ω	------

Max. offset ..... 50% of selected max. value
Cable resistance per wire (max.) ..... 10 Ω
Sensor current ..... > 0.2 mA, < 0.4 mA
Effect of sensor cable resistance
(3-wire) ..... < 0.002 Ω / Ω
Sensor error detection ..... Yes
Output:
Current Output:
Signal range ..... 4...20 mA
Min. signal range ..... 16 mA
Updating time ..... 135 ms
Load resistance ..... ≤ (Vsupply- 8) / 0.023 [Ω]
Load stability ..... < ±0.01% of span/100 Ω
Sensor Error Detection:
Programmable ..... 3.5...23 mA
NAMUR NE43 Upscale ..... 23 mA
NAMUR NE43 Downscale ..... 3.5 mA
Marine Approval:
Det Norske Veritas, Ships & Offshore ..... Standard for Certific. No. 2.4
Observed Authority Requirements: **Standard:**
EMC 2004/108/EC
Emission and immunity ..... EN 61326

Of span = Of the presently selected range
Loop Link = PC compatible programming software.

Request catalog 5005, our RTD & Thermocouple Assemblies Resource Guide

Visit www.conaxtechnologies.com for technical data on temperature sensors, thermocouples, RTDs, thermowells, transmitters, special assemblies and more.

Conax TECHNOLOGIES®

ISO 9001:2008 SGS

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Buffalo, New York 14225, USA
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Toll free in the USA at 1-800-223-2389
E-mail: sales@conaxtechnologies.com
Website: www.conaxtechnologies.com

SECTION 5

CONTROLS

SECTION 5.1

LOCAL CONTROL PANEL

Lone Star Blower
8883 West Monroe
Houston, TX 77061

PH: 832-532-3112
FAX: 832-532-3115

LONE STAR BLOWER/DYNAMIC SPECIALTIES
HOUSTON, TX
PROJECT #12175 – BROWNSVILLE PUBLIC UTILITY – LOCAL CONTROL PANEL

DRAWING NUMBER	TITLE	REV	DATE	STATUS	NOTES
12175–02–000	TITLE PAGE/DRAWING LIST	A	02/12/21	ISSUE FOR APPROVAL	
12175–02–001	SYMBOLS & WIRE LEGEND	A	02/12/21	ISSUE FOR APPROVAL	
12175–02–002	BILL OF MATERIALS	A	02/12/21	ISSUE FOR APPROVAL	
12175–02–100	ENCLOSURE & PANEL EQUIPMENT LAYOUTS	A	02/12/21	ISSUE FOR APPROVAL	
12175–02–200	POWER DISTRIBUTION	A	02/12/21	ISSUE FOR APPROVAL	
12175–02–201	NETWORK DIAGRAM	A	02/12/21	ISSUE FOR APPROVAL	
12175–02–202	ENCLOSURE INTERCONNECT DIA	A	02/12/21	ISSUE FOR APPROVAL	
12175–02–300	DISCRETE MODULE INTERCONNECT DIAGRAMS	A	02/12/21	ISSUE FOR APPROVAL	

NOTES:

LONE STAR BLOWER

DYNAMIC SPECIALTIES
HOUSTON, TEXAS

NO.	DATE MADE	BY	DESCRIPTION	DATE APPROVED	BY
A	02/12/21	EA	ISSUED FOR APPROVAL		

REVISIONS

BROWNSVILLE PUBLIC UTILITY
LS24-5 AIR BLOWER PACKAGE
LOCAL CONTROL PANEL
TITLE PAGE

DRAWN	CHK. DR.	DWG. NO.
EA	BQ	**12175-01-000**
DATE 02/12/21	SCALE NONE	

SYMBOL LEGEND			
PLAN	NAME	PLAN	NAME
	FUSED TERMINAL BLOCK		SINGLE POLE CIRCUIT BREAKER
	FEED–THROUGH TERMINAL BLOCK		DOUBLE POLE CIRCUIT BREAKER
	FUSE MODULAR TERMINAL BLOCK		MUSHROOM PUSHBUTTON NORMALLY CLOSED
	NORMALLY CLOSED CONTACT	+ - XX	TRANSMITTER
	NORMALLY OPEN CONTACT		LIGHT
	NORMALLY OPEN SWITCH		GROUND

WIRE TYPE LEGEND			
PLAN	NAME	PLAN	NAME
	PANEL WIRE		ANALOG INPUT
	FIELD WIRE		DIGITAL INPUT
	SHIELD WIRE		ANALOG OUTPUT
	ETHERNET		DIGITAL OUTPUT

PROJECT WIRING NOTES

1. ALL AC POWER WIRING SHALL BE STRANDED COPPER, 600V THHN/THWN, #12 AWG MINIMUM.
2. ALL DC POWER WIRING SHALL BE STRANDED COPPER, 600V TFFN, #16 AWG MINIMUM.
3. ALL DISCRETE I/O WIRING SHALL BE STRANDED COPPER, #16 AWG MINIMUM FOR OUTPUTS AND #18 AWG MINIMUM FOR INPUTS.
4. ALL ANALOG INSTRUMENT SIGNAL WIRING SHALL BE STRANDED COPPER, TWISTED W/SHIELD, 300V PVC INSULATION OR BETTER, #18 AWG MINIMUM. (BELDEN 8761 OR EQUAL)
5. ALL RTD SIGNAL WIRING SHALL BE STRANDED COPPER, TRIAD, 300V PVC INSULATION OR BETTER, #20 AWG MINIMUM.
6. COLOR CODES
   A. AC WIRING (HOT – BLACK, NEUTRAL – WHITE, GROUND – GREEN)
   B. DC POWER WIRING (POSITIVE – BLUE, NEGATIVE – WHITE/BLUE, GROUND – GREEN)
   C. DC CONTROL WIRING (POSITIVE – BLUE OR ANY OTHER COLOR THAN BLACK, WHITE, OR GREEN, NEGATIVE – WHITE/BLUE, SIGNAL GROUND – GREEN/YELLOW. MULTI–CONDUCTOR CABLES MAY BE USED IF INDIVIDUALLY COLOR–CODED.

NOTES:

LONE STAR BLOWER

DYNAMIC SPECIALTIES
HOUSTON, TEXAS

NO.	DATE MADE	BY	DESCRIPTION	DATE APPROVED	BY
A	02/12/21	EA	ISSUED FOR APPROVAL		

REVISIONS

BROWNSVILLE PUBLIC UTILITY
LS24-5 AIR BLOWER PACKAGE
LOCAL CONTROL PANEL
LEGENDS & NOTES

DRAWN	CHK. DR.	DWG. NO.
EA	BQ	12175-01-001
DATE 02/12/21	SCALE NONE	

BILL OF MATERIALS

ITEM	QTY	MANUFACTURER	PART NUMBER	DESCRIPTION
1	1	HAMMOND	1418KK12	WALL MOUNT ENCLOSURE W/PANEL, 30X30X12
2	1	ALLEN BRADLEY	2711P-T9W21D8S	HMI, 9" TOUCH SCREEN, COLOR, 1 ETH, 24V
3	1	ALLEN BRADLEY	800HC-QRTH2W	PUSH TO TEST LIGHT, 24V, LED WHITE
4	1	ALLEN BRADLEY	800HC-FRXT6A5S	PUSH-PULL/TWIST TO RELEASE, 2 NCLB
5	1	ALLEN BRADLEY	800H-W373	LEGEND PLATE, EMERGENCY STOP, RED
6	1	ALLEN BRADLEY	800S-R2SX	OFF-ON SELECTOR/DISCONNECT SWITCH
7	1	ALLEN BRADLEY	5069-L306ER	COMPACTLOGIX 5370 CONTROLLER
8	1	ALLEN BRADLEY	5069-RTB64-SCREW	COMPACTLOGIX POWER TERMINAL RTB KIT
9	1	ALLEN BRADLEY	5069-IB16	COMPACTLOGIX 16 PT DIGITAL INPUT
10	1	ALLEN BRADLEY	5069-OB8	COMPACTLOGIX 8 PT DIGITAL OUTPUT
11	1	ALLEN BRADLEY	5069-ECR	COMPACTLOGIX RIGHT END CAP/TERMINATOR
12	1	PHOENIX CONTACT	2891036	MANAGED ETHERNET SWITCH, 6 RJ45, 2 SC FIB
13	1	PHOENIX CONTACT	2859084	ETHERNET SURGE PROTECTOR
14	1	PHOENIX CONTACT	2907566	THERMOMAGNETIC CIRCUIT BREAKER, 10A, 1P
15	1	PHOENIX CONTACT	0804152	SINGLE RECEPTACLE, 120V, 15A
16	1	PHOENIX CONTACT	2907918	SURGE PROTECTION DEVICE, TYPE 2/3, 120V
17	1	PHOENIX CONTACT	1067327	QUINT UPS, DIN RAIL MOUNT, 120V, 500VA
18	1	PHOENIX CONTACT	2320319	EXTERNAL BATTERY PACK
19	1	PHOENIX CONTACT	2903151	POWER SUPPLY, TRIO POWER, 24VDC, 20A
20	2	ALLEN BRADLEY	700-HLT12Z24	RELAY MODULE, DPDT, 24V, 10A
21	19	ALLEN BRADLEY	1492-EAJ35	TERMINAL BLOCK END ANCHOR
22	10	ALLEN BRADLEY	1492-GM35	TERMINAL STRIP MARKER CARRIER
23	1	ALLEN BRADLEY	1492-J4	FEED THROUGH TB, GRAY
24	1	ALLEN BRADLEY	1492-EBJ3	TERMINAL BLOCK END COVER
25	3	ALLEN BRADLEY	1492-JD3FB120	TWO TIER FUSE BLOCK, 120V, LED
26	18	ALLEN BRADLEY	1492-JD3FB24	TWO TIER FUSE BLOCK, 24V, LED
27	4	ALLEN BRADLEY	1492-EBJD3FB	TWO TIER FUSE BLOCK END BARRIER
28	1	PHOENIX CONTACT	0402174	BUSBAR, 10X3X1000MM, COPPER TIN-PLATED
29	4	PHOENIX CONTACT	0404415	GROUND BAR SUPPORT BRACKET
30	15	PHOENIX CONTACT	0404017	GROUND CONNECTION TERMINAL
31	2	PHOENIX CONTACT	0801733	DIN RAIL, PERFORATED, 6FT STICK
32	1	PHOENIX CONTACT	3240631	WIRE DUCT, WHITE (2"X4"X6')
33	1	PHOENIX CONTACT	3240623	WIRE DUCT, WHITE (1"X4"X6')

NAMEPLATE LEGEND

ITEM	COLOR	NAMEPLATE SIZE	CHAR. SIZE	FIRST LINE	SECOND LINE
①	WHT/BLK LTR	1" X 3"	1/4"	CABLCP-VALVE	
②	WHT/BLK LTR	1" X 2"	1/4"	POWER ON	
③	WHT/BLK LTR	1" X 2"	1/4"	120VAC-LINE	
④	WHT/BLK LTR	1" X 2"	1/4"	RECPT	
⑤	WHT/BLK LTR	1/4" X 1 3/4"	1/8"	SPD	
⑥	WHT/BLK LTR	1/4" X 1 3/4"	1/8"	UPS	
⑦	WHT/BLK LTR	1/4" X 1 3/4"	1/8"	120VAC	
⑧	WHT/BLK LTR	1/4" X 1 3/4"	1/8"	PS-24V	
⑨	WHT/BLK LTR	1/4" X 1 3/4"	1/8"	24VDC	
⑩	WHT/BLK LTR	1/4" X 1 3/4"	1/8"	TS-DO	
⑪	WHT/BLK LTR	1/4" X 1 3/4"	1/8"	RELAYS	
⑫	WHT/BLK LTR	1/4" X 1 3/4"	1/8"	TS-DI	

LABEL SCHEDULE

LBL1 LSB INFORMATION LABEL:

PROJECT NO. 12175
LINE VOLTAGE: 120 VAC PHASE: 1 PH, 60 HZ
CONTROL VOLTAGE: 24VDC
ENCLOSURE TYPE: NEMA 12

LBL2 USE COPPER CONDUCTORS ONLY.
RECOMMENDED TORQUES: 6.0 LB INS.

LBL3 UL 508A LABEL

LBL4 TYPE 12 ENCLOSURE

MAIN DISCONNECT AND BRANCH CIRCUIT PROTECTION TO BE PROVIDED BY OTHERS

FUSE SCHEDULE – TO REDUCE THE POTENTIAL OF A FIRE, REPLACE WITH SAME TYPE AND SIZE FUSES.

NO.	TYPE	MAX. AMP	MIN. VOLTS
120V-F1-F3	GMA	10A	250
24V-F1-F10	GMA	2A	250
DIGITAL INPUT	GMA	2A	250
DIGITAL OUTPUT	GMA	3A	250
ANALOG INPUT	GMA	.25A	250

NOTES:

LONE STAR BLOWER

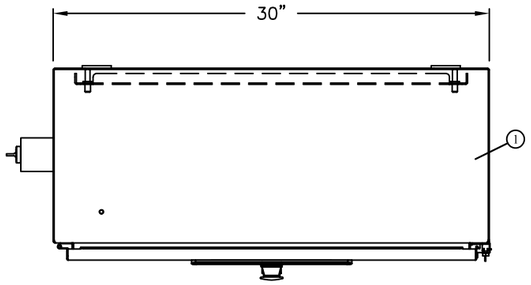
DYNAMIC SPECIALTIES
HOUSTON, TEXAS

NO.	DATE	BY	DESCRIPTION	DATE	BY
A	02/12/21	EA	ISSUED FOR APPROVAL		
	MADE			APPROVED	

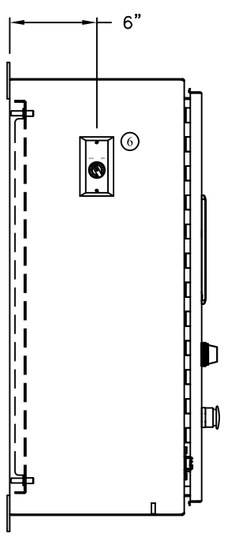
REVISIONS

BROWNSVILLE PUBLIC UTILITY
LS24-5 AIR BLOWER PACKAGE
LOCAL CONTROL PANEL
BILL OF MATERIALS

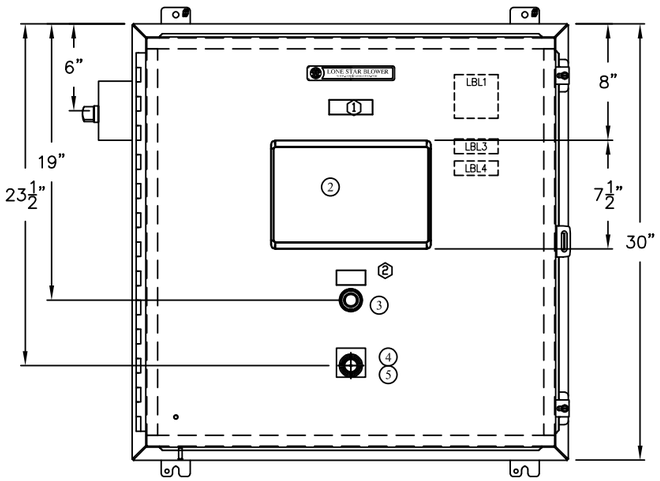
DRAWN	CHK. DR.	DWG. NO.
EA	BQ	12175-01-002
DATE: 02/12/21	SCALE: NONE	



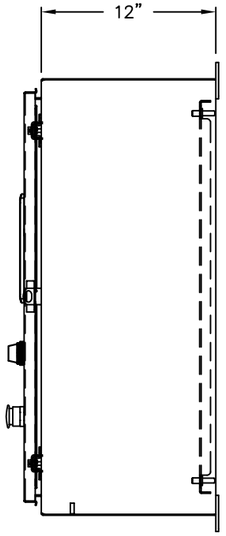
Enclosure Top Layout
30" X 30" X 12" NEMA 12
UL Listed



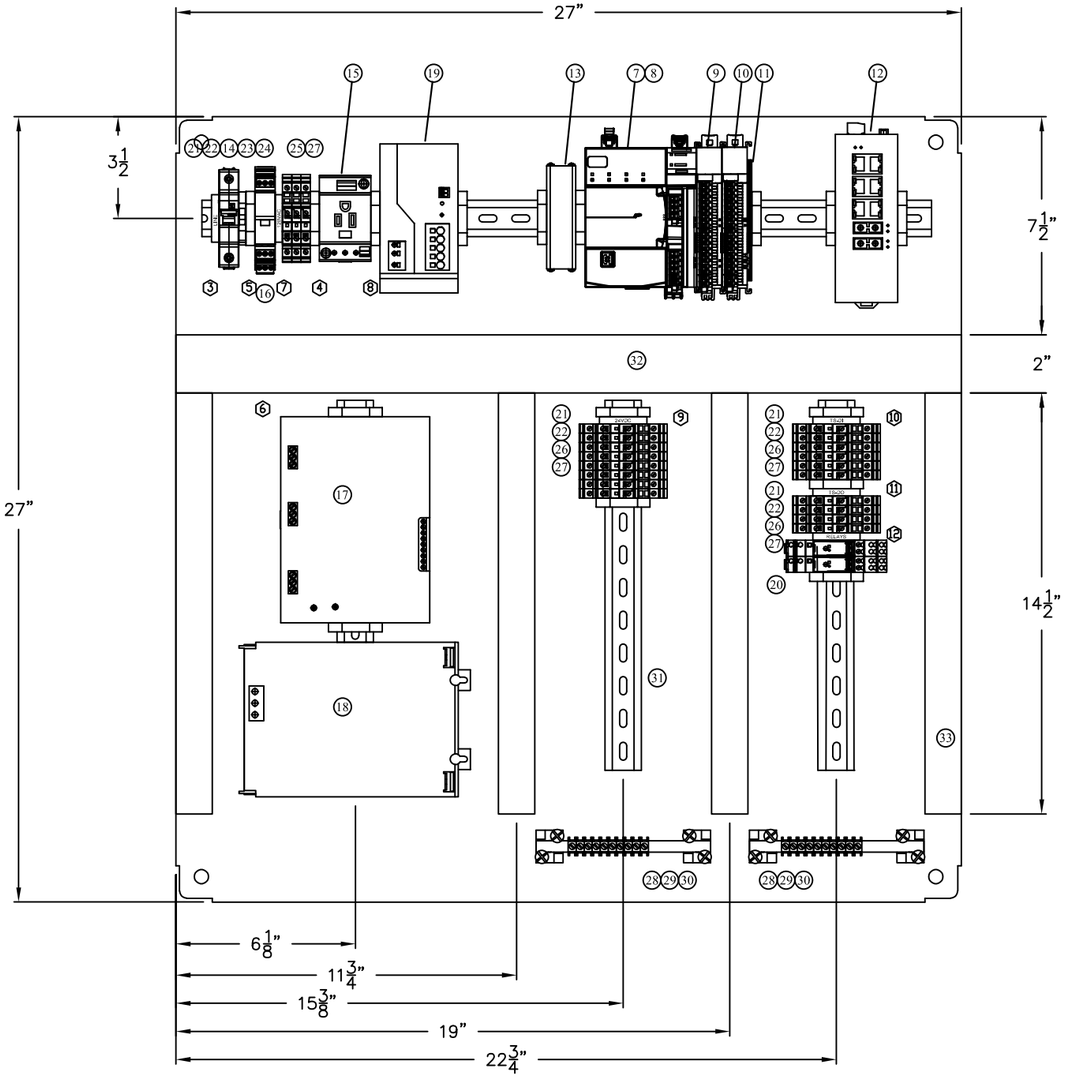
Enclosure Left Side Layout
30" X 30" X 12" NEMA 12
UL Listed



Enclosure Front Layout
30" X 30" X 12" NEMA 12
UL Listed



Enclosure Right Side Layout
30" X 30" X 12" NEMA 12
UL Listed



Inner Panel Layout
Scale: 1:5

NOTES:

LONE STAR BLOWER

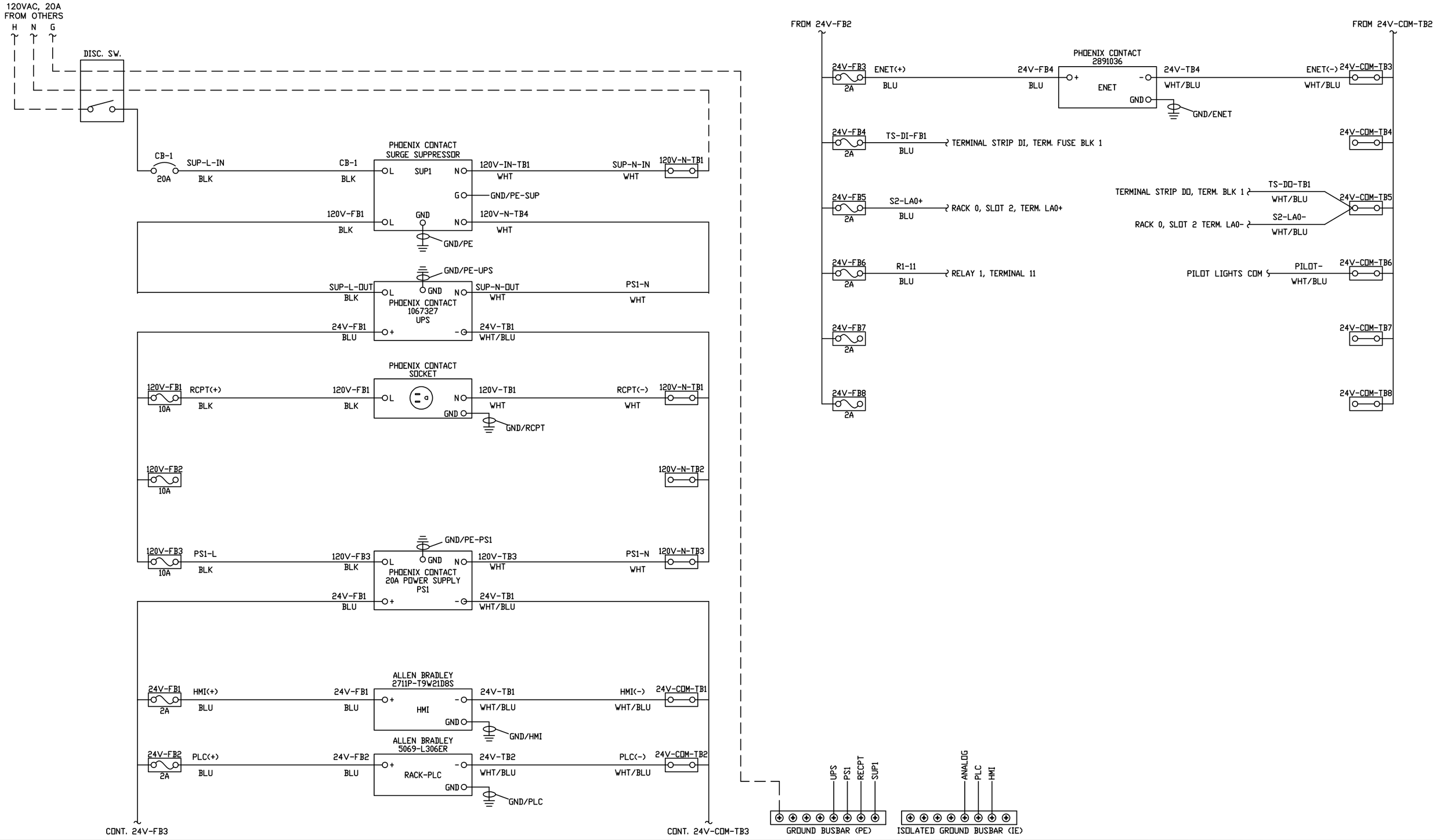
DYNAMIC SPECIALTIES
HOUSTON, TEXAS

NO.	DATE MADE	BY	DESCRIPTION	DATE APPROVED	BY
A	02/12/21	EA	ISSUED FOR APPROVAL		

REVISIONS

BROWNSVILLE PUBLIC UTILITY
LS24-5 AIR BLOWER PACKAGE
LOCAL CONTROL PANEL
ENCLOSURE & PANEL LAYOUT

DRAWN	CHK. DR.	DWG. NO.
EA	BQ	12175-01-100
DATE 02/12/21	SCALE NONE	



NOTES:

LONE STAR BLOWER

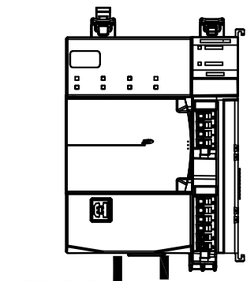
DYNAMIC SPECIALTIES
HOUSTON, TEXAS

NO.	DATE MADE	BY	DESCRIPTION	DATE APPROVED	BY
A	02/12/21	EA	ISSUED FOR APPROVAL		

REVISIONS

BROWNSVILLE PUBLIC UTILITY
LS24-5 AIR BLOWER PACKAGE
LOCAL CONTROL PANEL
POWER DISTRIBUTION

DRAWN	CHK. DR.	DWG. NO.
EA	BQ	12175-01-200
DATE 02/12/21	SCALE NONE	

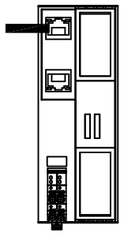


LCP PLC

LCP
ETHERNET SPD

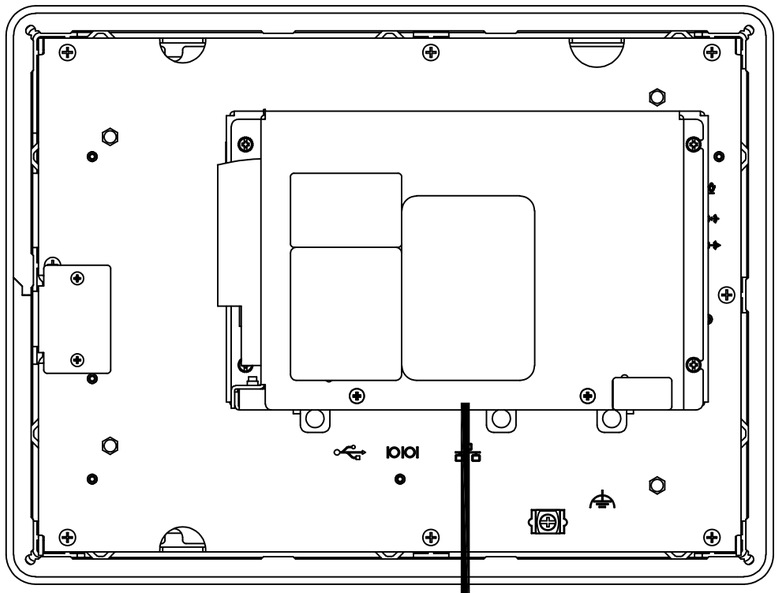
ETHERNET SPD
(IN BLOWER SKID
JBOX)

PHOENIX BUS
(IN BLOWER SKID
JBOX)



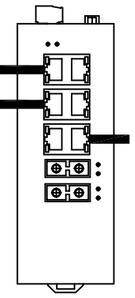
ETHERNET CABLE TO BLOWER SKID

ETHERNET CABLE



LCP HMI

LCP ETHERNET
SWITCH



PLANT SCADA

ETHERNET CABLE

NOTES:

LONE STAR BLOWER

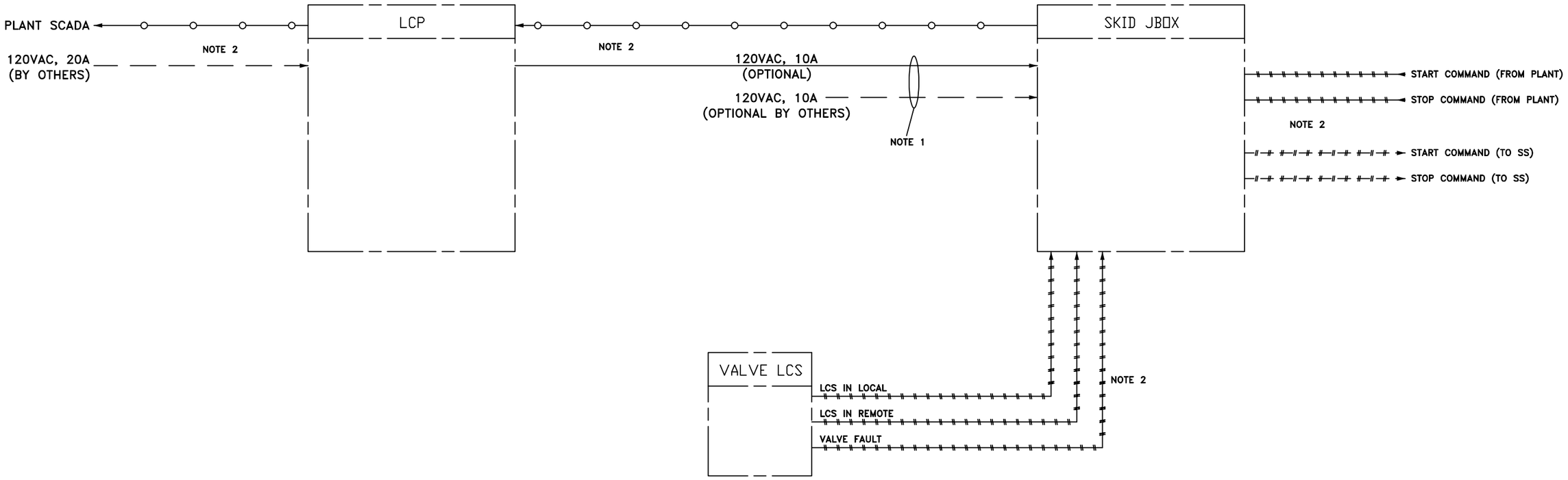
DYNAMIC SPECIALTIES
HOUSTON, TEXAS

NO.	DATE MADE	BY	DESCRIPTION	DATE APPROVED	BY
A	02/12/21	EA	ISSUED FOR APPROVAL		

REVISIONS

BROWNSVILLE PUBLIC UTILITY
LS24-5 AIR BLOWER PACKAGE
LOCAL CONTROL PANEL
NETWORK DIAGRAM

DRAWN	CHK. DR.	DWG. NO.
EA	BQ	**12175-01-201**
DATE 02/12/21	SCALE NONE	



NOTES:
1. Options shown for supplying 120V to skid junction box. Option 1 can be supplied via the LCP 120V power strip. Option 2 can be supplied by a facility provided 120V circuit.
2. All wiring shown is by others.

LONE STAR BLOWER

DYNAMIC SPECIALTIES
HOUSTON, TEXAS

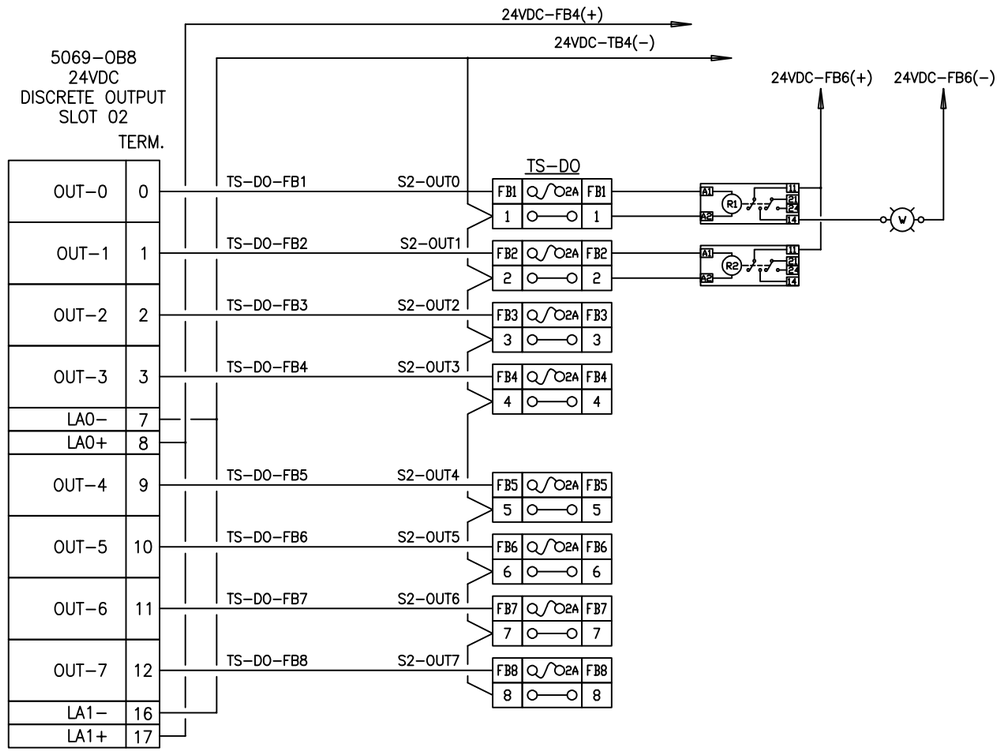
NO.	DATE MADE	BY	DESCRIPTION	DATE APPROVED	BY
A	02/12/21	EA	ISSUED FOR APPROVAL		

REVISIONS

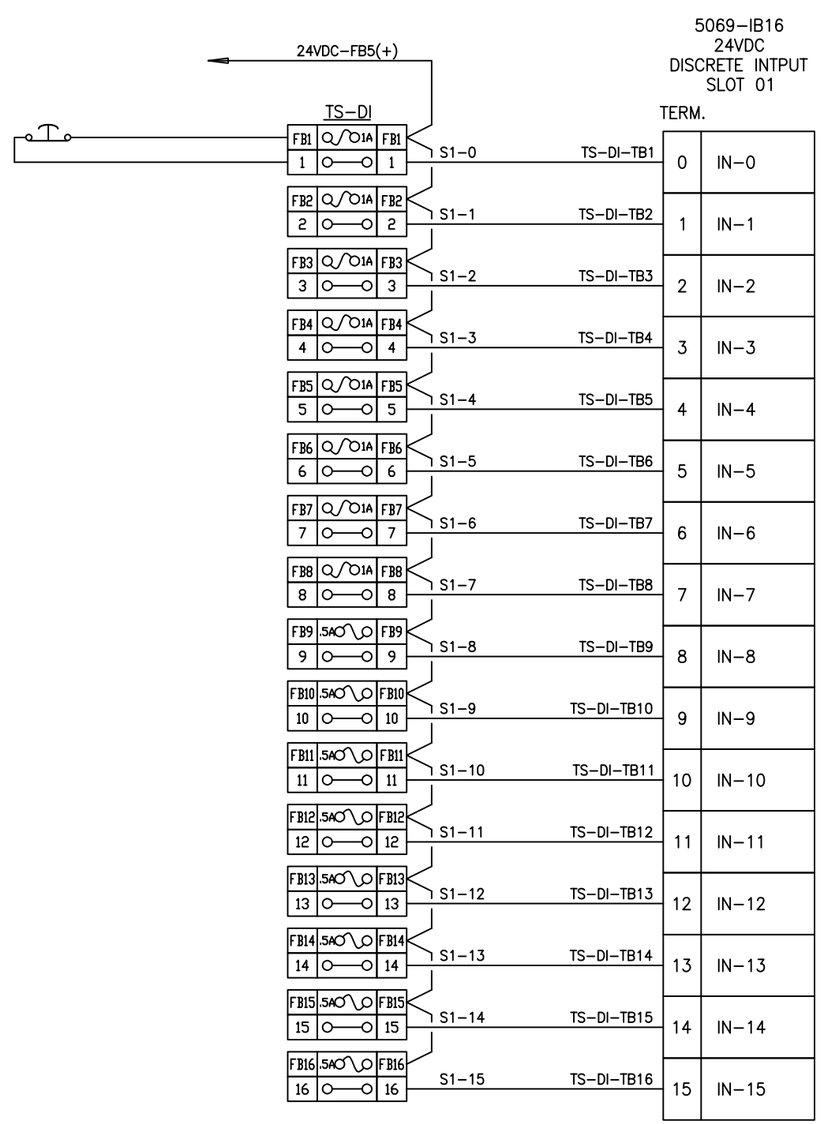
BROWNSVILLE PUBLIC UTILITY
LS24-5 AIR BLOWER PACKAGE
POWER, SIGNAL & COMMUNICATIONS DIAGRAM

DRAWN	CHK. DR.	DWG. NO.
EA	BQ	12175-01-202
DATE 02/12/21	SCALE NONE	

CONTROL PANEL	FIELD DEVICE	DESCRIPTION	DESCRIPTION	FIELD DEVICE	CONTROL PANEL



POWER ON PILOT LIGHT	EMERGENCY STOP
SPARE	SPARE
SPARE	SPARE
SPARE	SPARE
	SPARE
	SPARE
	SPARE
	SPARE
	SPARE
	SPARE
	SPARE
	SPARE
	SPARE



NOTES:

LONE STAR BLOWER

DYNAMIC SPECIALTIES
HOUSTON, TEXAS

NO.	DATE MADE	BY	DESCRIPTION	DATE APPROVED	BY
A	02/12/21	EA	ISSUED FOR APPROVAL		

REVISIONS

BROWNSVILLE PUBLIC UTILITY
LS24-5 AIR BLOWER PACKAGE
LOCAL CONTROL PANEL
DISCRETE MODULE INTERCONNECT DIA.

DRAWN	CHK. DR.	DWG. NO.
EA	BQ	12175-01-300
DATE 02/12/21	SCALE NONE	

SECTION 5.2

LOCAL CONTROL PANEL J-BOX

Lone Star Blower
8883 West Monroe
Houston, TX 77061

PH: 832-532-3112
FAX: 832-532-3115

LONE STAR BLOWER/DYNAMIC SPECIALTIES
HOUSTON, TX
PROJECT #12175 – BROWNSVILLE PUBLIC UTILITY – BLOWER SKID JBOX

DRAWING NUMBER	TITLE	REV	DATE	STATUS	NOTES
12175–02–000	TITLE PAGE/DRAWING LIST	A	02/12/21	ISSUE FOR APPROVAL	
12175–02–001	SYMBOLS & WIRE LEGEND	A	02/12/21	ISSUE FOR APPROVAL	
12175–02–002	BILL OF MATERIALS	A	02/12/21	ISSUE FOR APPROVAL	
12175–02–100	ENCLOSURE & PANEL EQUIPMENT LAYOUTS	A	02/12/21	ISSUE FOR APPROVAL	
12175–02–200	POWER DISTRIBUTION	A	02/12/21	ISSUE FOR APPROVAL	
12175–02–300	DISCRETE MODULE INTERCONNECT DIAGRAMS	A	02/12/21	ISSUE FOR APPROVAL	
12175–02–500	ANALOG INPUT MODULE INTERCONNECT DIAGRAM	A	02/12/21	ISSUE FOR APPROVAL	
12175–02–600	ANALOG OUTPUT MODULE INTERCONNECT DIAGRAM	A	02/12/21	ISSUE FOR APPROVAL	
12175–02–700	RTD INPUT MODULE INTERCONNECT DIAGRAM	A	02/12/21	ISSUE FOR APPROVAL	

NOTES:

LONE STAR BLOWER

DYNAMIC SPECIALTIES
HOUSTON, TEXAS

NO.	DATE MADE	BY	DESCRIPTION	DATE APPROVED	BY
A	02/12/21	EA	ISSUED FOR APPROVAL		

REVISIONS

BROWNSVILLE PUBLIC UTILITY
LS24-5 AIR BLOWER PACKAGE
SKID JUNCTION BOX
TITLE PAGE

DRAWN	CHK. DR.	DWG. NO.
EA	BQ	**12175-02-000**
DATE 02/12/21	SCALE NONE	

SYMBOL LEGEND			
PLAN	NAME	PLAN	NAME
	FUSED TERMINAL BLOCK		SINGLE POLE CIRCUIT BREAKER
	FEED–THROUGH TERMINAL BLOCK		DOUBLE POLE CIRCUIT BREAKER
	FUSE MODULAR TERMINAL BLOCK		MUSHROOM PUSHBUTTON NORMALLY CLOSED
	NORMALLY CLOSED CONTACT	+ − XX	TRANSMITTER
	NORMALLY OPEN CONTACT		LIGHT
	NORMALLY OPEN SWITCH		GROUND

WIRE TYPE LEGEND			
PLAN	NAME	PLAN	NAME
	PANEL WIRE		ANALOG INPUT
	FIELD WIRE		DIGITAL INPUT
	SHIELD WIRE		ANALOG OUTPUT
	ETHERNET		DIGITAL OUTPUT

PROJECT WIRING NOTES

1. ALL AC POWER WIRING SHALL BE STRANDED COPPER, 600V THHN/THWN, #12 AWG MINIMUM.
2. ALL DC POWER WIRING SHALL BE STRANDED COPPER, 600V TFFN, #16 AWG MINIMUM.
3. ALL DISCRETE I/O WIRING SHALL BE STRANDED COPPER, #16 AWG MINIMUM FOR OUTPUTS AND #18 AWG MINIMUM FOR INPUTS.
4. ALL ANALOG INSTRUMENT SIGNAL WIRING SHALL BE STRANDED COPPER, TWISTED W/SHIELD, 300V PVC INSULATION OR BETTER, #18 AWG MINIMUM. (BELDEN 8761 OR EQUAL)
5. ALL RTD SIGNAL WIRING SHALL BE STRANDED COPPER, TRIAD, 300V PVC INSULATION OR BETTER, #20 AWG MINIMUM.
6. COLOR CODES
   A. AC WIRING (HOT – BLACK, NEUTRAL – WHITE, GROUND – GREEN)
   B. DC POWER WIRING (POSITIVE – BLUE, NEGATIVE – WHITE/BLUE, GROUND – GREEN)
   C. DC CONTROL WIRING (POSITIVE – BLUE OR ANY OTHER COLOR THAN BLACK, WHITE, OR GREEN, NEGATIVE – WHITE/BLUE, SIGNAL GROUND – GREEN/YELLOW. MULTI–CONDUCTOR CABLES MAY BE USED IF INDIVIDUALLY COLOR–CODED.

NOTES:

LONE STAR BLOWER

DYNAMIC SPECIALTIES
HOUSTON, TEXAS

NO.	DATE MADE	BY	DESCRIPTION	DATE APPROVED	BY
A	02/12/21	EA	ISSUED FOR APPROVAL		

REVISIONS

BROWNSVILLE PUBLIC UTILITY
LS24-5 AIR BLOWER PACKAGE
SKID JUNCTION BOX
LEGENDS & NOTES

DRAWN	CHK. DR.	DWG. NO.
EA	BQ	12175-02-001
DATE 02/12/21	SCALE NONE	

BILL OF MATERIALS

ITEM	QTY	MANUFACTURER	PART NUMBER	DESCRIPTION
1	1	HAMMOND	HN4WM24428S16	ENCLOSURE W/PANEL, 24X42X8, 4X, 316SS
2	1	HAMMOND	BKWM2408	ENCLOSURE BARRIER FOR 24"H X 8"D
3	1	ALLEN BRADLEY	800HC-QRTH2W	PUSH TO TEST LIGHT, 24V, LED WHITE
4	1	ALLEN BRADLEY	800HC-QRTH2R	PUSH TO TEST LIGHT, 24V, LED RED
5	1	ALLEN BRADLEY	800HC-QRTH2A	PUSH TO TEST LIGHT, 24V, LED AMBER
6	1	ALLEN BRADLEY	800HC-FRXT6A5S	PUSH-PULL/TWIST TO RELEASE, 2 NCLB
7	1	ALLEN BRADLEY	800H-W373	LEGEND PLATE, EMERGENCY STOP, RED
8	1	PHOENIX CONTACT	2702782	AXC F BUS COUPLER, ETH/IP, RJ45
9	1	PHOENIX CONTACT	2702106	AXC F DI16/DO16 2H DIGITAL IO MODULE
10	2	PHOENIX CONTACT	2688064	AXC F AI8 1F, ANALOG INPUT MODULE
11	1	PHOENIX CONTACT	2688527	AXC F AO4 1H, ANALOG OUTPUT MODULE
12	1	PHOENIX CONTACT	2688077	AXC F RTD8 1F, RTD MODULE
13	1	ALLEN BRADLEY	1492-SPM1D100	THERMOMAGNETIC CIRCUIT BREAKER, 10A, 1P
14	7	ALLEN BRADLEY	700-HLT12Z24	RELAY MODULE, DPDT, 24V, 10A
15	1	PHOENIX CONTACT	2859084	ETHERNET SURGE PROTECTOR
16	1	PHOENIX CONTACT	2907918	SURGE PROTECTION DEVICE, TYPE 2/3, 120V
17	1	PHOENIX CONTACT	2903149	POWER SUPPLY, 10A, TRIO-PS-2G/1AC/24DC/10
18	21	ALLEN BRADLEY	1492-EAJ35	TERMINAL BLOCK END ANCHOR
19	10	ALLEN BRADLEY	1492-GM35	TERMINAL STRIP MARKER CARRIER
20	1	ALLEN BRADLEY	1492-J4	FEED THROUGH TB, GRAY
21	1	ALLEN BRADLEY	1492-EBJ3	TERMINAL BLOCK END COVER
22	3	ALLEN BRADLEY	1492-JD3FB120	TWO TIER FUSE BLOCK, 120V, LED
23	42	ALLEN BRADLEY	1492-JD3FB24	TWO TIER FUSE BLOCK, 24V, LED
24	20	ALLEN BRADLEY	1492-JDG3FB24	TWO TIER FUSE BLOCK WITH GROUND, 24V, LED
25	8	ALLEN BRADLEY	1492-EBJD3FB	TWO TIER FUSE BLOCK END BARRIER
26	8	ALLEN BRADLEY	1492-JT3M	THREE TIER FUSE BLOCK WITH GROUND
27	1	ALLEN BRADLEY	1492-EBJ3TM	THREE TIER FUSE BLOCK END BARRIER
28	1	PHOENIX CONTACT	0402174	BUSBAR, 10X3X1000MM, COPPER TIN-PLATED
29	4	PHOENIX CONTACT	0404415	GROUND BAR SUPPORT BRACKET
30	15	PHOENIX CONTACT	0404017	GROUND CONNECTION TERMINAL
31	2	PHOENIX CONTACT	0801733	DIN RAIL, PERFORATED, 6FT STICK
32	4FT	PANDUIT	G2X4WH6	PANDUIT WIRE DUCT, WHITE (2X4)
33	4FT	PANDUIT	C2WH6	2" PANDUIT WIRE DUCT COVER, WHITE
34	8FT	PANDUIT	G1X4WH6	PANDUIT WIRE DUCT, WHITE (1X4)
35	8FT	PANDUIT	C1WH6	1" PANDUIT WIRE DUCT COVER, WHITE

NAMEPLATE LEGEND

ITEM	COLOR	NAMEPLATE SIZE	CHAR. SIZE	FIRST LINE	SECOND LINE
①	WHT/BLK LTR	1" X 3"	1/4"	CABLCP-JBOX	
②	WHT/BLK LTR	1" X 2"	3/16"	POWER ON	
③	WHT/BLK LTR	1" X 2"	3/16"	BLOWER	RUNNING
④	WHT/BLK LTR	1" X 2"	3/16"	BLOWER	FAULT
⑤	WHT/BLK LTR	1/4" X 1 3/4"	1/8"	120VAC-IN	
⑥	WHT/BLK LTR	1/4" X 1 3/4"	1/8"	120VAC	
⑦	WHT/BLK LTR	1/4" X 1 3/4"	1/8"	24VDC	
⑧	WHT/BLK LTR	1/4" X 1 3/4"	1/8"	TS-DI	
⑨	WHT/BLK LTR	1/4" X 1 3/4"	1/8"	TS-AI1	
⑩	WHT/BLK LTR	1/4" X 1 3/4"	1/8"	TS-AI2	
⑪	WHT/BLK LTR	1/4" X 1 3/4"	1/8"	TS-RTD	
⑫	WHT/BLK LTR	1/4" X 1 3/4"	1/8"	TS-DO	
⑬	WHT/BLK LTR	1/4" X 1 3/4"	1/8"	RELAYS	
⑭	WHT/BLK LTR	1/4" X 1 3/4"	1/8"	TS-AO	

LABEL SCHEDULE

LBL1 LSB INFORMATION LABEL:

PROJECT NO. 12175
LINE VOLTAGE: 120VAC PHASE: 1, 60HZ
CONTROL VOLTAGE: 24VDC
ENCLOSURE TYPE: NEMA 4X

LBL2 USE COPPER CONDUCTORS ONLY.
RECOMMENDED TORQUES: 6.0 LB INS.

LBL3 UL 508A LABEL

LBL4 TYPE 4X ENCLOSURE

MAIN DISCONNECT AND BRANCH CIRCUIT PROTECTION TO BE PROVIDED BY OTHERS

FUSE SCHEDULE – TO REDUCE THE POTENTIAL OF A FIRE, REPLACE WITH SAME TYPE AND SIZE FUSES.

NO.	TYPE	MAX. AMP	MIN. VOLTS
24V-F1-F10	GMA	2A	250
DIGITAL INPUT	GMA	2A	250
DIGITAL OUTPUT	GMA	3A	250
ANALOG INPUT	GMA	.25A	250
ANALOG OUTPUT	GMA	.25A	250

NOTES:

LONE STAR BLOWER

DYNAMIC SPECIALTIES
HOUSTON, TEXAS

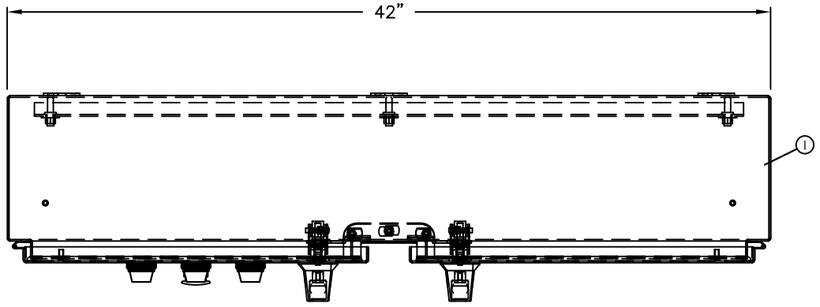
NO.	DATE	BY	DESCRIPTION	DATE	BY
A	02/12/21	EA	ISSUED FOR APPROVAL		

MADE APPROVED

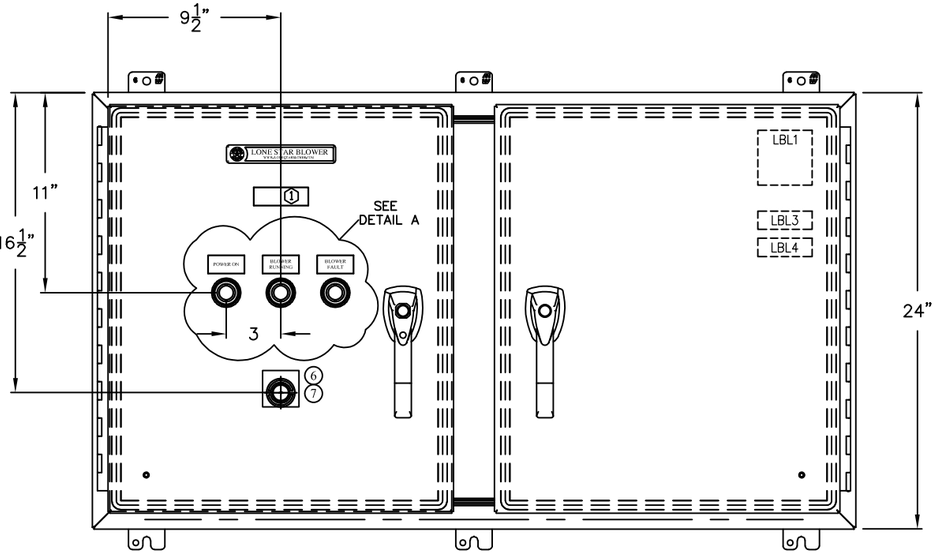
REVISIONS

BROWNSVILLE PUBLIC UTILITY
LS24-5 AIR BLOWER PACKAGE
SKID JUNCTION BOX
BILL OF MATERIALS

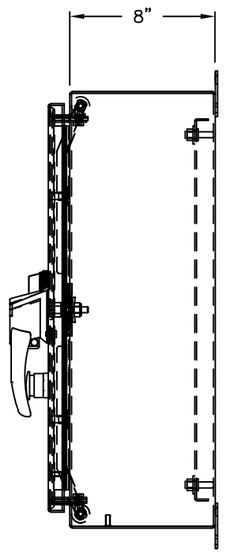
DRAWN	CHK. DR.	DWG. NO.
EA	BQ	12175-02-002
DATE: 02/12/21	SCALE: NONE	



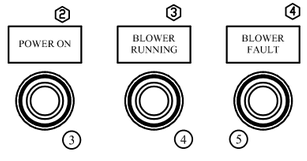
Enclosure Top Layout
24" X 42" X 8" NEMA 4X
UL Listed



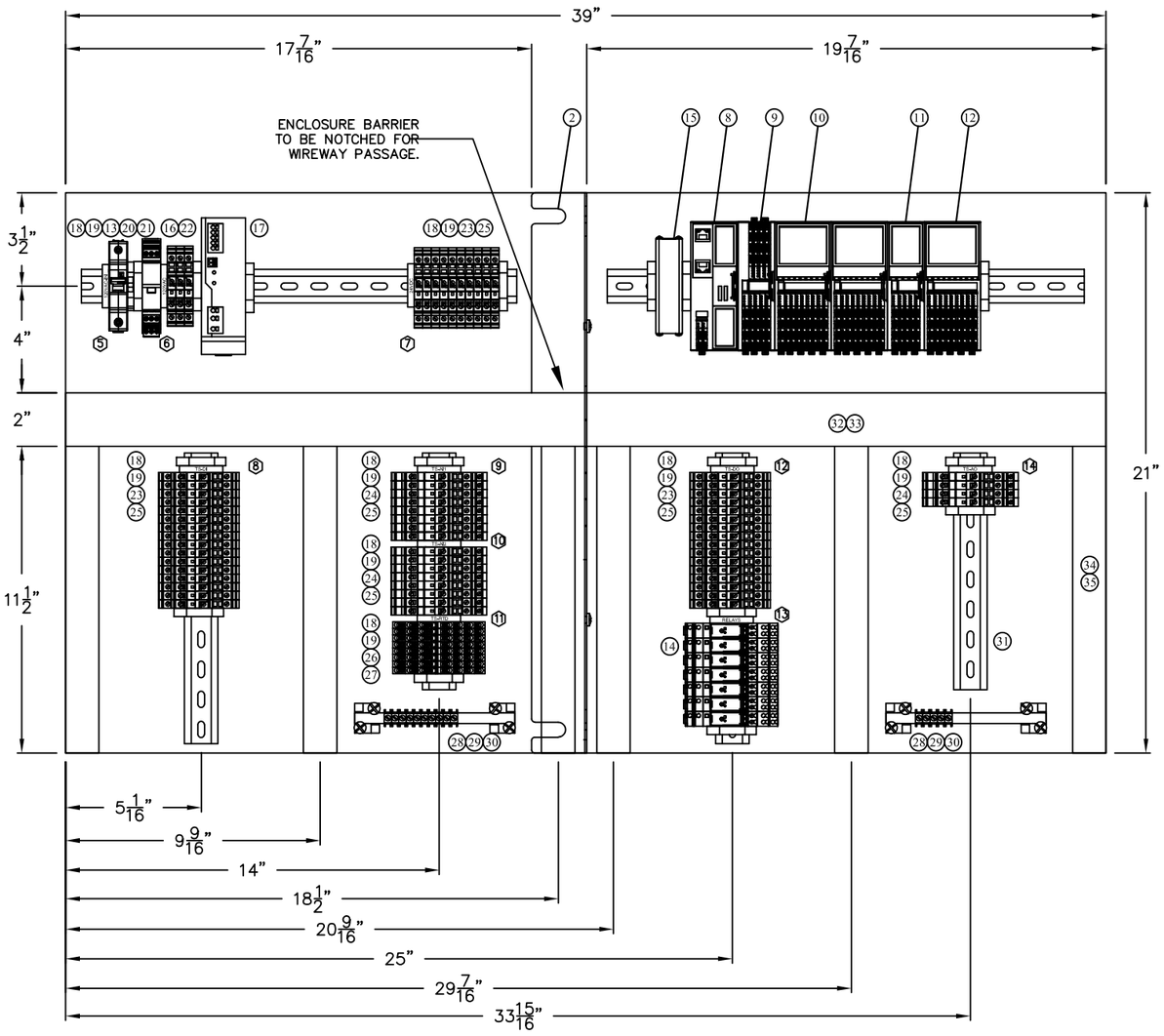
Enclosure Front Layout
24" X 42" X 8" NEMA 4X
UL Listed



Enclosure Side Layout
24" X 42" X 8" NEMA 4X
UL Listed



Detail A:
Power On - White
Blower Running - Red
Blower Fault - Amber



Inner Panel Layout
Scale: 1:5

NOTES:

LONE STAR BLOWER

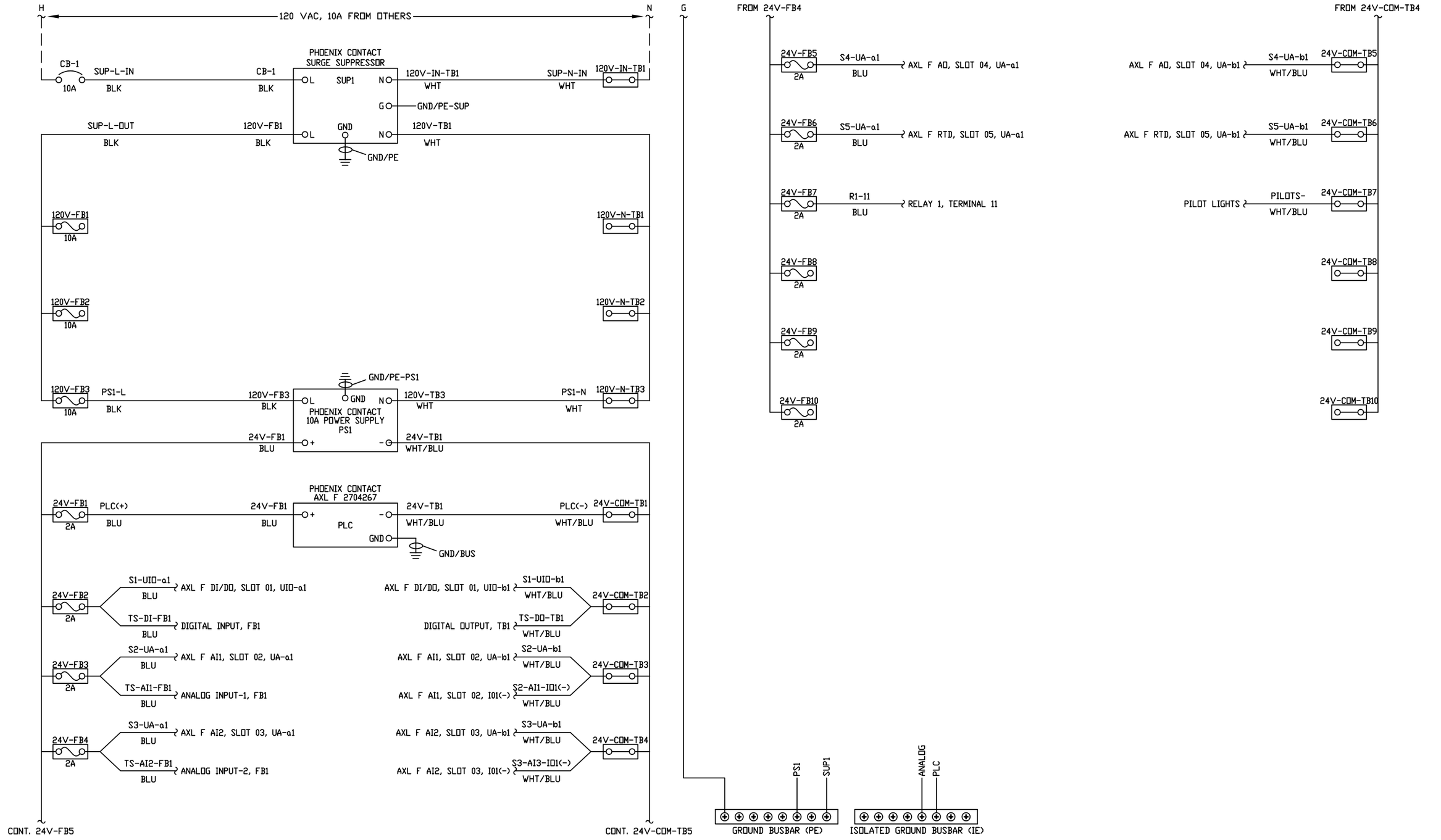
DYNAMIC SPECIALTIES
HOUSTON, TEXAS

NO.	DATE MADE	BY	DESCRIPTION	DATE APPROVED	BY
A	02/12/21	EA	ISSUED FOR APPROVAL		

REVISIONS

BROWNSVILLE PUBLIC UTILITY
LS24-5 AIR BLOWER PACKAGE
SKID JUNCTION BOX
ENCLOSURE & PANEL LAYOUT

DRAWN	CHK. DR.	DWG. NO.
EA	BQ	12175-02-100
DATE 02/12/21	SCALE NONE	



NOTES:

LONE STAR BLOWER

DYNAMIC SPECIALTIES
HOUSTON, TEXAS

NO.	DATE	BY	DESCRIPTION	DATE	BY
A	02/12/21	EA	ISSUED FOR APPROVAL		
	DATE MADE			DATE APPROVED	

REVISIONS

BROWNSVILLE PUBLIC UTILITY
LS24-5 AIR BLOWER PACKAGE
SKID JUNCTION BOX
POWER DISTRIBUTION

DRAWN	CHK. DR.	DWG. NO.
EA	BQ	12175-02-200
DATE 02/12/21	SCALE NONE	

CONTROL PANEL | FIELD DEVICE | DESCRIPTION | DESCRIPTION | FIELD DEVICE | CONTROL PANEL

AXL F DI/DO
24VDC
DISCRETE OUTPUT
SLOT 01

TERM.	
UIO	a1
UIO	b1
OUT–1	00
OUT–2	01
OUT–3	02
OUT–4	03
OUT–5	10
OUT–6	11
OUT–7	12
OUT–8	13
OUT–9	20
OUT–10	21
OUT–11	22
OUT–12	23
OUT–13	30
OUT–14	31
OUT–15	32
OUT–16	33

24VDC–FB2(+)
24VDC–TB2(–)
24VDC–FB7(+)
24VDC–FB7(–)

TS–DO

TS–DO–FB1	S1–00	FB1 1 FB1 1
TS–DO–FB2	S1–01	FB2 2 FB2 2
TS–DO–FB3	S1–02	FB3 3 FB3 3
TS–DO–FB4	S1–03	FB4 4 FB4 4
TS–DO–FB5	S1–10	FB5 5 FB5 5
TS–DO–FB6	S1–11	FB6 6 FB6 6
TS–DO–FB7	S1–12	FB7 7 FB7 7
TS–DO–FB8	S1–13	FB8 8 FB8 8
TS–DO–FB9	S1–20	FB9 9 FB9 9
TS–DO–FB10	S1–21	FB10 10 FB10 10
TS–DO–FB11	S1–22	FB11 11 FB11 11
TS–DO–FB12	S1–23	FB12 12 FB12 12
TS–DO–FB13	S1–30	FB13 13 FB13 13
TS–DO–FB14	S1–31	FB14 14 FB14 14
TS–DO–FB15	S1–32	FB15 15 FB15 15
TS–DO–FB16	S1–33	FB16 16 FB16 16

R1 R2 R3 R4 R5 R6 R7 W R A

~ SS
~ SS

POWER ON PILOT LIGHT	EMERGENCY STOP
BLOWER RUNNING PILOT LIGHT	RUN STATUS (FROM SS)
BLOWER FAULT PILOT LIGHT	COMMON ALARM (FROM SS)
START COMMAND (TO SS)	SURGE FAULT
STOP COMMAND (TO SS)	START COMMAND (FROM PLANT)
SPARE	STOP COMMAND (FROM PLANT)
SPARE	INLET VALVE OPEN (VALVE ACTUATOR)
SPARE	INLET VALVE CLOSED (VALVE ACTUATOR)
SPARE	SPARE
SPARE	SPARE
SPARE	SPARE
SPARE	SPARE
SPARE	SPARE
SPARE	SPARE
SPARE	SPARE
SPARE	SPARE

SK7 9 8 7 6

FROM UIO–a1
FROM UIO–b1
24VDC–FB2(+)

TS–DI

FB1 1 FB1 1	S1–40	TS–DI–1
FB2 2 FB2 2	S1–41	TS–DI–2
FB3 3 FB3 3	S1–42	TS–DI–3
FB4 4 FB4 4	S1–43	TS–DI–4
FB5 5 FB5 5	S1–50	TS–DI–5
FB6 6 FB6 6	S1–51	TS–DI–6
FB7 7 FB7 7	S1–52	TS–DI–7
FB8 8 FB8 8	S1–53	TS–DI–8
FB9 .5A FB9 9 9	S1–60	TS–DI–9
FB10 .5A FB10 10 10	S1–61	TS–DI–10
FB11 .5A FB11 11 11	S1–62	TS–DI–11
FB12 .5A FB12 12 12	S1–63	TS–DI–12
FB13 .5A FB13 13 13	S1–70	TS–DI–13
FB14 .5A FB14 14 14	S1–71	TS–DI–14
FB15 .5A FB15 15 15	S1–72	TS–DI–15
FB16 .5A FB16 16 16	S1–73	TS–DI–16

AXL F DI/DO
24VDC
DISCRETE INPUT
SLOT 01 CONTINUED

TERM.	
a2	UIO
b2	UIO
40	IN–1
41	IN–2
42	IN–3
43	IN–4
50	IN–5
51	IN–6
52	IN–7
53	IN–8
60	IN–9
61	IN–10
62	IN–11
63	IN–12
70	IN–13
71	IN–14
72	IN–15
73	IN–16

NOTES:

LONE STAR BLOWER

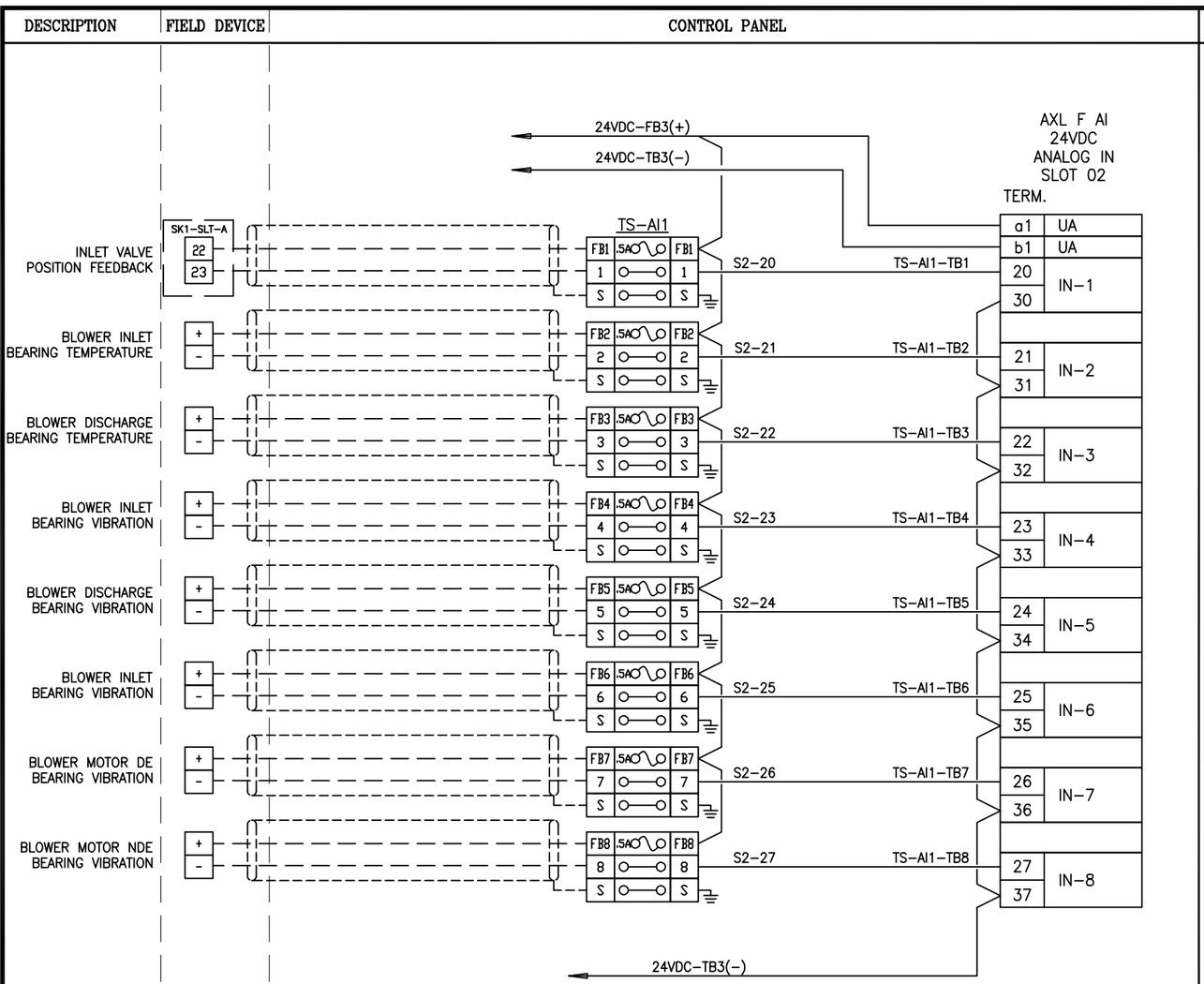
DYNAMIC SPECIALTIES
HOUSTON, TEXAS

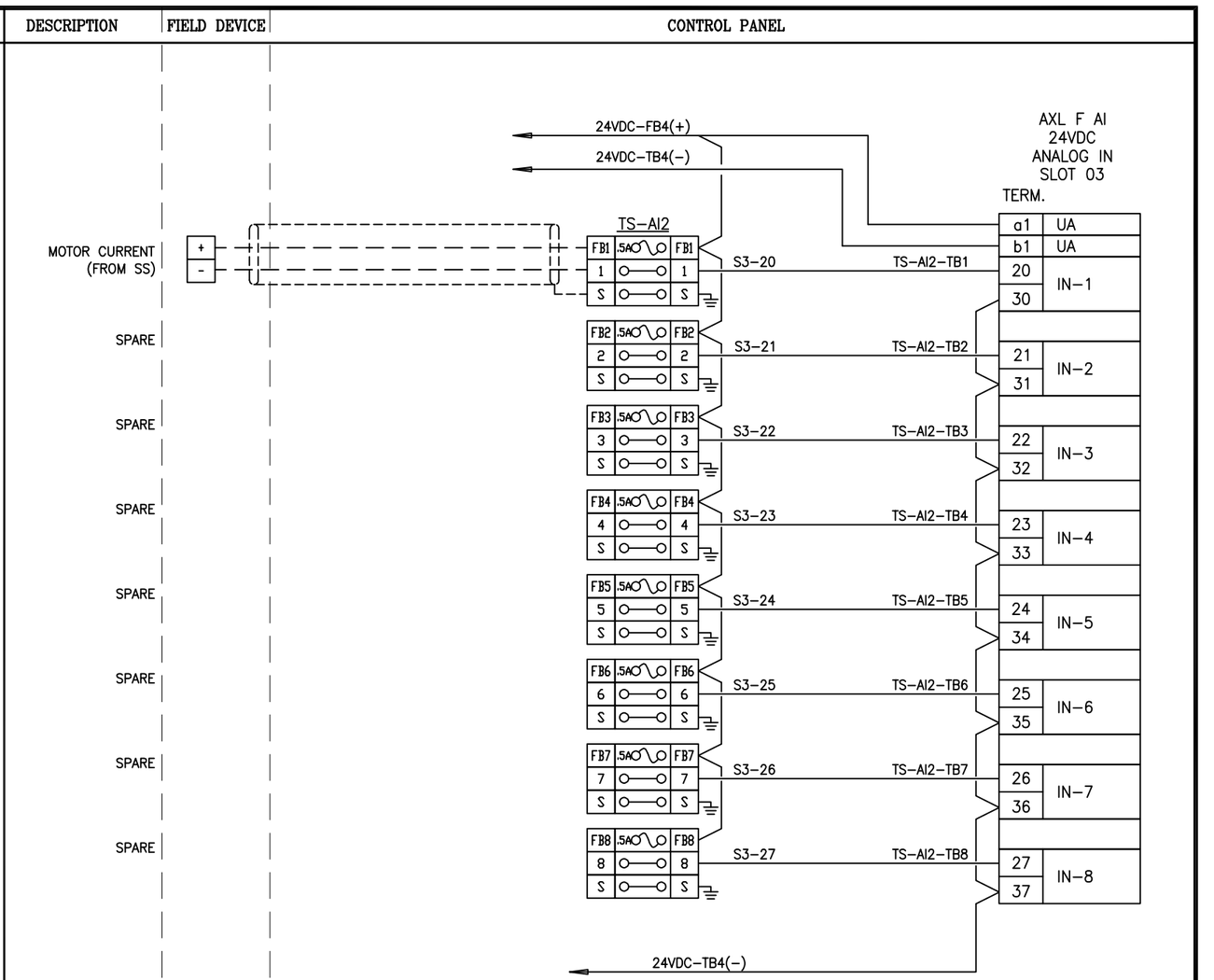
NO.	DATE MADE	BY	DESCRIPTION	DATE APPROVED	BY
A	02/12/21	EA	ISSUED FOR APPROVAL		

REVISIONS

BROWNSVILLE PUBLIC UTILITY
LS24-5 AIR BLOWER PACKAGE
SKID JUNCTION BOX
DISCRETE MODULE INTERCONNECT DIA.

DRAWN	CHK. DR.	DWG. NO.
EA	BQ	12175-02-300
DATE 02/12/21	SCALE NONE	





NOTES:

LONE STAR BLOWER

DYNAMIC SPECIALTIES
HOUSTON, TEXAS

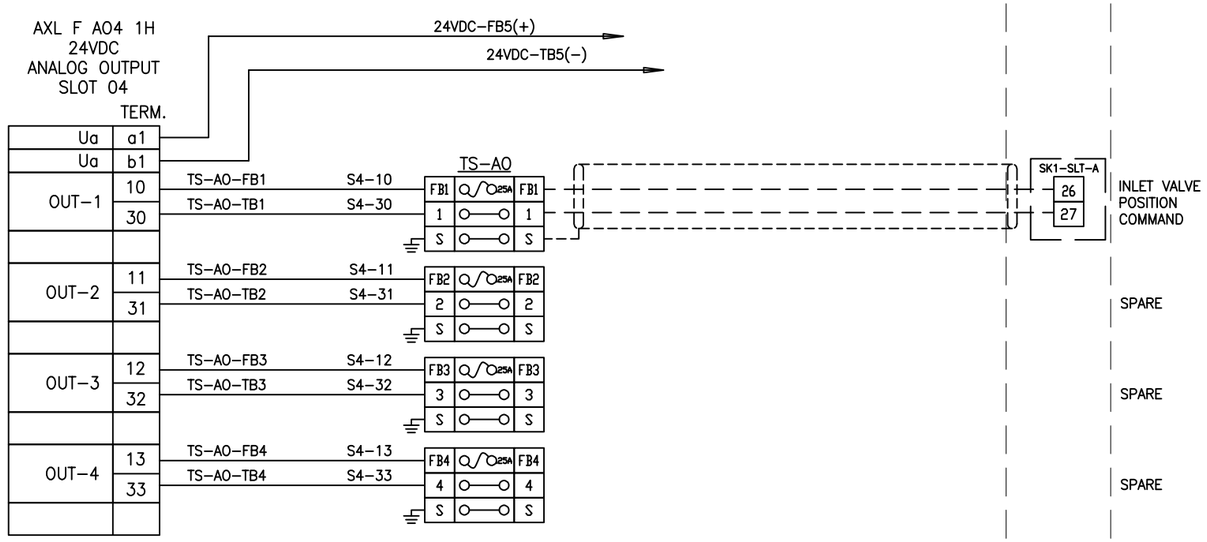
NO.	DATE MADE	BY	DESCRIPTION	DATE APPROVED	BY
A	02/12/21	EA	ISSUED FOR APPROVAL		

REVISIONS

BROWNSVILLE PUBLIC UTILITY
LS24-5 AIR BLOWER PACKAGE
SKID JUNCTION BOX
ANALOG INPUT INTERCONNECT DIA.

DRAWN	CHK. DR.	DWG. NO.
EA	BQ	**12175-02-500**
DATE 02/12/21	SCALE NONE	

CONTROL PANEL	FIELD DEVICE	DESCRIPTION



CONTROL PANEL	FIELD DEVICE	DESCRIPTION

NOTES:

LONE STAR BLOWER

DYNAMIC SPECIALTIES
HOUSTON, TEXAS

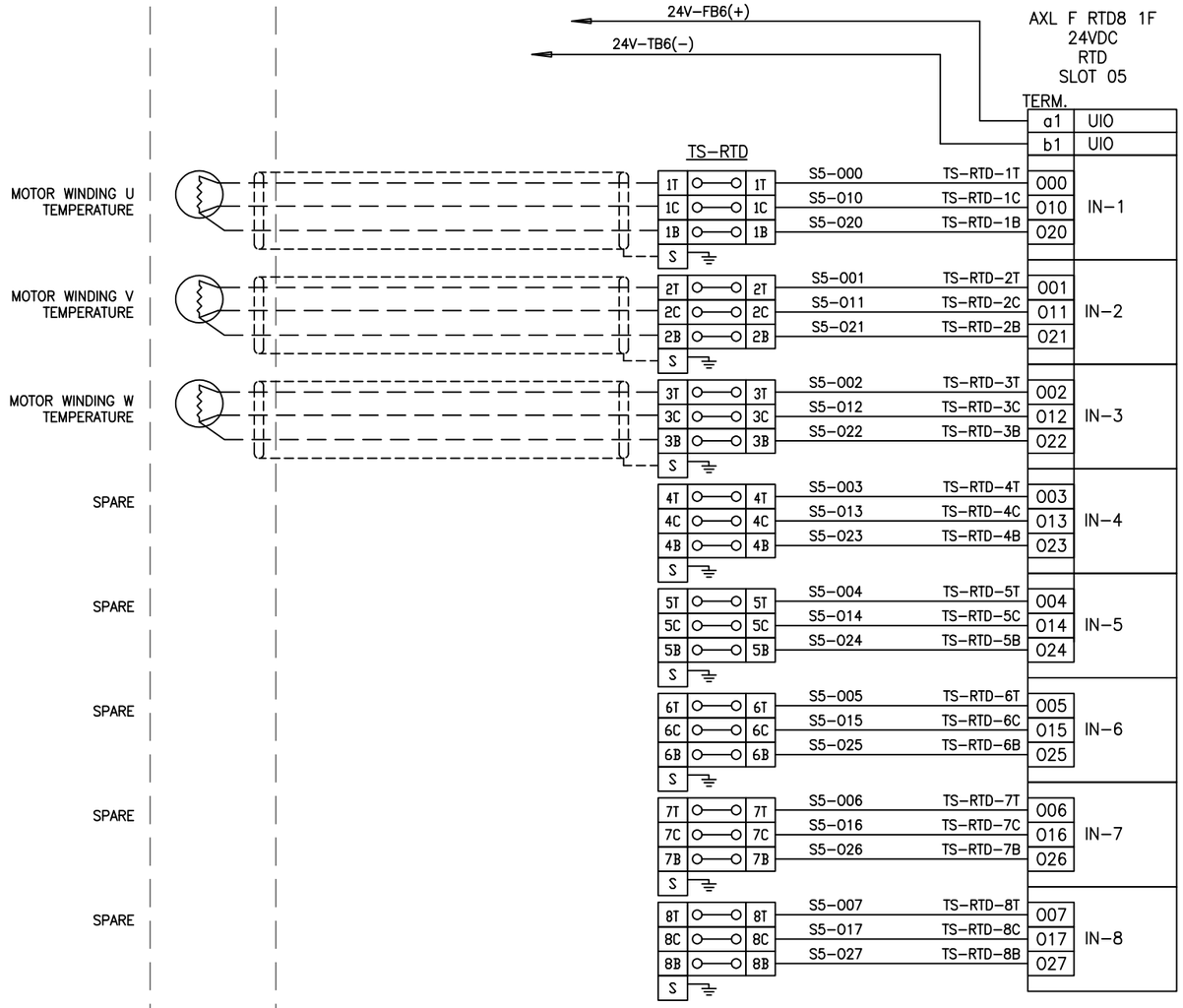
NO.	DATE MADE	BY	DESCRIPTION	DATE APPROVED	BY
A	02/12/21	EA	ISSUED FOR APPROVAL		

REVISIONS

BROWNSVILLE PUBLIC UTILITY
LS24-5 AIR BLOWER PACKAGE
SKID JUNCTION BOX
ANALOG OUTPUT INTERCONNECT DIA.

DRAWN	CHK. DR.	DWG. NO.
EA	BQ	**12175-02-600**
DATE 02/12/21	SCALE NONE	

DESCRIPTION	FIELD DEVICE	CONTROL PANEL



DESCRIPTION	FIELD DEVICE	CONTROL PANEL

NOTES:

LONE STAR BLOWER

DYNAMIC SPECIALTIES
HOUSTON, TEXAS

NO.	DATE MADE	BY	DESCRIPTION	DATE APPROVED	BY
A	02/12/21	EA	ISSUED FOR APPROVAL		

REVISIONS

BROWNSVILLE PUBLIC UTILITY
LS24-5 AIR BLOWER PACKAGE
SKID JUNCTION BOX
RTD INPUT INTERCONNECT DIA.

DRAWN	CHK. DR.	DWG. NO.
EA	BQ	12175-02-700
DATE 02/12/21	SCALE NONE	

SECTION 6

SPARE PARTS

SECTION 6.1

INLET FILTER ELEMENTS

Lone Star Blower
8883 West Monroe
Houston, TX 77061

PH: 832-532-3112
FAX: 832-532-3115

Tri-Vent® Series P09

Intake Filter Silencers

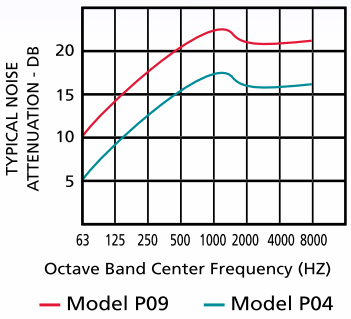
No Compromise

For a generation, everyone assumed that high-efficiency filters increased maintenance costs, and the only way to make a filter element last longer was to allow more dirt to pass through. This is known as "the filtration compromise."

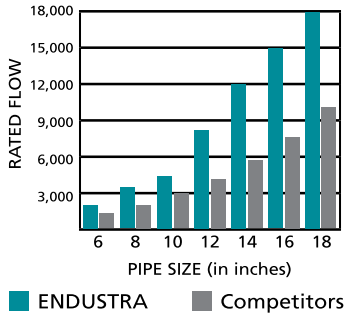
Tri-Vent® technology makes no compromise. Our high-efficiency filters reduce energy consumption, and our exclusive Enduralast® Synthetic Media provide optimal filter element life in the harshest environments.

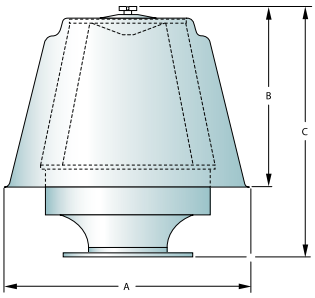
Reduce cost, reduce weight, and reduce maintenance. Don't compromise.

TYPICAL NOISE ATTENUATION



RATED FLOW COMPARISON





Model #	Enduralast® Element Number		FLG Size	Nominal Dimensions			Rated Flow SCFM	Weight
	Ultra Synthetic, 99.97% eff. @ 1-µ (nom)	Hi-Flow Synthetic, 98% eff. @ 10-µ (nom)		A	B	C		
P09RG-	LSB1513	LSB1523	3"	16	8	18	600	30
P09RH-	LSB1513	LSB1523	4"	16	8	18	900	30
P09RR-	LSB1513	LSB1523	5"	16	8	18	1100	30
P09RI-	LSB1513	LSB1523	6"	16	8	18	1350	30
P09RI-	LSB1514	LSB1524	6"	26	11	21	2000	50
P09RI-	LSB1515	LSB1525	6"	27	15	25	2250	60
P09RJ-	LSB1514	LSB1524	8"	26	11	21	2500	60
P09RJ-	LSB1515	LSB1525	8"	27	15	25	2900	70
P09RJ-	LSB1516	LSB1526	8"	28	20	29	3300	75
P09RK-	LSB1514	LSB1524	10"	26	11	21	3750	70
P09RK-	LSB1515	LSB1526	10"	27	15	25	4000	75
P09RK-	LSB1516	LSB1526	10"	28	20	29	4250	80
P09RL-	LSB1515	LSB1525	12"	27	15	25	5150	85
P09RL-	LSB1516	LSB1526	12"	28	20	29	6500	85
P09RL-	LSB1517	LSB1527	12"	38	26	35	8250	90
P09RM-	LSB1517	LSB1527	14"	38	26	35	12,000	105
P09RN-	LSB1517	LSB1527	16"	38	26	35	15,000	115
P09RS-	LSB1517	LSB1527	18"	38	26	35	18,000	125

Options

- 3-6" NPT connections
- Wire Mesh Medium, 60% eff. @ ISO Fine Dust
- Stainless steel or aluminum
- Custom fittings
- Special coatings
- FDA/USDA standards
- HEPA/ULPA
- Over 75 media types

ENDUSTRA
Endustra Filter Manufacturers • 1145 Birch Drive, Schererville, Indiana 46375
800-521-1008 • 219-322-1550 • FAX: 219-322-5870 • www.endustrafilters.com

Enduralast® Synthetic Media

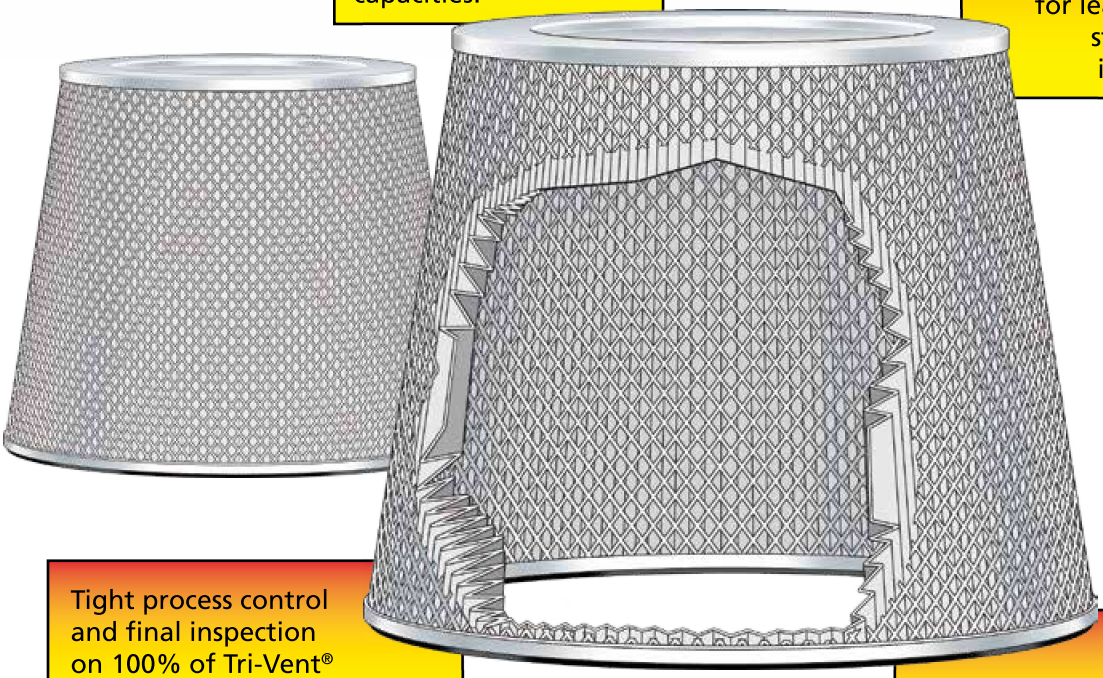
All-Weather Capacity

Another Tri-Vent® exclusive: proprietary Enduralast® Synthetic Media resist moisture and humidity for consistent performance in all climates.

Enduralast®'s low pressure drops and high dust-holding capacities combined with the superior flow characteristics of a conical element outperform standard paper and polyester.

Hydrophobic, oil-resistant, 99.97% efficient @ 1-micron (nom) Ultra Synthetic replaces old-fashioned paper. For extended life in severe environments, 98% efficient @ 10-micron (nom) Hi-Flow Synthetic can double the capacity of standard polyester.

Tri-Vent® elements are also available in wire mesh, HEPA/ULPA, and over seventy-five different medium types.



ENDUSTRA
Endustra Filter Manufacturers • 1145 Birch Drive, Schererville, Indiana 46375
800-521-1008 • 219-322-1550 • FAX: 219-322-5870 • www.endustrafilters.com

SECTION 6.2

PLC MODULES

AB - 5069-IB16 (INPUT MODULE)
AB - 5069-OB8 (OUTPUT MODULE)

Lone Star Blower
8883 West Monroe
Houston, TX 77061

PH: 832-532-3112
FAX: 832-532-3115

Technical Data

Original Instructions

Compact 5000 I/O Modules and EtherNet/IP Adapters

Catalog Numbers

Digital I/O Modules	5069-IA16, 5069-IB16, 5069-IB16F, 5069-IB16K, 5069-IB6F-3W, 5069-OA16, 5069-OB8, 5069-OB16, 5069-OB16F, 5069-OB16K, 5069-OW4I, 5069-OW16, 5069-OX4I
Analog I/O Modules	5069-IF8, 5069-IY4, 5069-IY4K, 5069-OF4, 5069-OF4K, 5069-OF8
High-speed Counter Module	5069-HSC2xOB4
Safety I/O Modules	5069-IB8S, 5069-IB8SK, 5069-OBV8S, 5069-OBV8SK
Serial Module	5069-SERIAL
Field Potential Distributor	5069-FPD
Address Reserve Module	5069-ARM
EtherNet/IP Adapters	5069-AENTR, 5069-AENTRK, 5069-AEN2TR

The Compact 5000™ I/O architecture provides a wide range of input and output modules to span many applications, from high-speed digital to process control. The architecture uses Producer/Consumer technology that allows input information and output status to be shared among multiple Logix 5000™ controllers.

Compact 5000 I/O modules are used as local I/O modules in CompactLogix™ 5380 and Compact GuardLogix® 5380 controller systems. The modules are also used as remote I/O modules with CompactLogix 5380, Compact GuardLogix 5380 controllers, and some other Logix 5000 controllers. You use the Studio 5000 Logix Designer® application to configure the modules.

The I/O modules require a removable terminal block (RTB) to connect field-side wiring. RTBs are not included with the I/O modules. You must order RTBs separately.

Summary of Changes

The publication was revised for the following changes.

Topic	Pages
Changed the 5069-OB16, 5069-OB16F, and 5069-OB16K module specifications to indicate that only the Series B hardware supports Field Power Loss Detection.	30
Changed the 5069-IY4 and 5069-IY4K module wiring diagrams with different devices that are connected to the module.	59, 60, 64, and 65
Changed the 5069-IB8S and 5069-IB8SK module wiring diagrams to show normally closed contacts, instead of normally open contacts, which are connected to the module.	82...84

Power Compact 5000 I/O Modules

There are different types of power that are used with Compact 5000 I/O modules.

Power Type	Description	Related Specifications	
		Name	Description
Module (MOD) Power	System-side power that is used to operate a local or remote system. Power passes across a MOD Power bus. Modules draw current from the bus and pass the remaining current to the next module.	MOD Power	Level of MOD Power current that the module draws from the MOD Power bus
		MOD Power Passthrough max	Maximum level of MOD Power current that the module can pass to the next module.
Sensor/ Actuator (SA) Power	Field-side power that some modules use to power field-side devices. Power passes across an SA Power bus. Some modules draw current from the bus and pass the remaining current to the next module. Other modules do not draw current from the bus but do pass the current to the next module. You use 5069-FPD field potential distributors to establish new SA Power buses in a system. **IMPORTANT**: Remember the following: • If the system includes DC type modules and AC type modules, you must use a field potential distributor to install them on separate SA Power buses. • You cannot install AC type modules directly next to a Compact GuardLogix 5380 controller. You must first install a field potential distributor.	SA Power	Level of SA Power current that the module draws from the SA Power bus
		SA Power Passthrough max	Maximum level of SA Power current that the module can pass to the next module.
Local Actuator (LA) Power	Field-side power that some Compact 5000 I/O modules use instead of SA power. Modules that use LA power **do not use SA power**. They only pass SA power to the next to the next I/O module in the system. You must install modules that use LA Power on an SA Power bus with the same module type. For example, you must install a 5069-OB8 module on an SA Power bus that includes DC type modules.	LA Power	Maximum level of LA Power current that you can apply to the module, by channel, group, or module.

For more information on MOD power, SA power, and LA power, see the user manuals that are listed in Additional Resources on page 137.

Digital I/O Modules

I/O Type	Cat. No.	Description	Pages
AC digital input	5069-IA16	79...264V AC 16-point, input module	4
DC digital input	5069-IB16	10...32V DC 16-point, sinking input module	9
	5069-IB16K	10...32V DC 16-point, conformal coated sinking input module	
	5069-IB16F	10...32V DC 16-point, sinking fast input module	
	5069-IB6F-3W	10...32V DC 6-point, 3-wire, sinking fast input module	14
AC digital output	5069-OA16	85...264V AC 16-point, output module	19
DC digital output	5069-OB8	10...32V DC 8-point, sourcing high-current output module	24
	069-OB16	10...32V DC 16-point, sourcing high-current output module	29
	5069-OB16K	10...32V DC 16-point, conformal coated sourcing output module	
	5069-OB16F	10...32V DC 16-point, sourcing fast output module	
Relay output	5069-OW4I	5...264V AC /125V DC 4-point, isolated normally open relay output module	35
	5069-OW16	5...264V AC/125V DC 16-point, normally open relay output module	40
	5069-OX4I	5...264V AC /125V DC 4-point, isolated normally open/normally closed relay output module	45

5069-IB16, 5069-IB16K, and 5069-IB16F Digital 16-point Sinking Input Modules

The following figure shows a wiring diagram for the 5069-IB16, 5069-IB16K, and 5069-IB16F modules.

5069-IB16, 5069-IB16K, and 5069-IB16F Wiring Diagram

Channel Connections

The example shows devices that are connected to channels 0, 3, and 6. You are not restricted to using only those channels. You can connect devices to any channel or combination of channels as needed.

SA Power

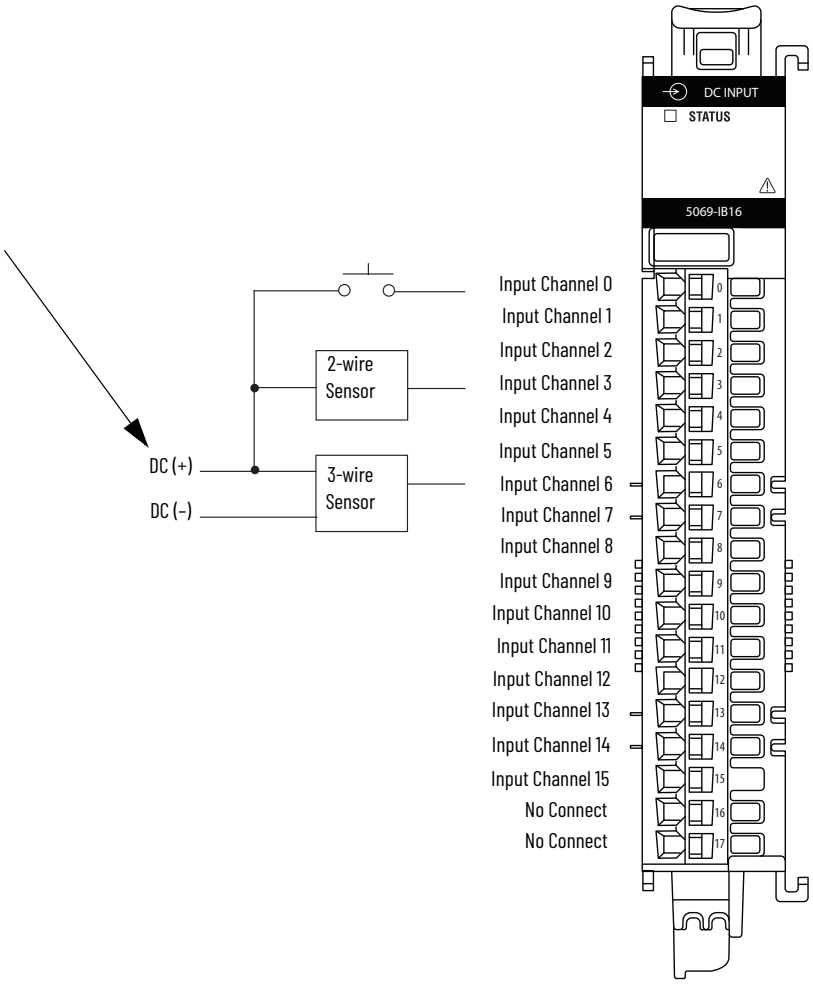
Connections to an external power supply that provides SA power via the SA Power RTB on one of the following:

- CompactLogix 5380 controller
- Compact GuardLogix 5380 controller
- CompactLogix 5480 controller
- 5069-AENTR or 5069-AEN2TR EtherNet/IP Adapter
- 5069-FPD field potential distributor

IMPORTANT: Remember the following:

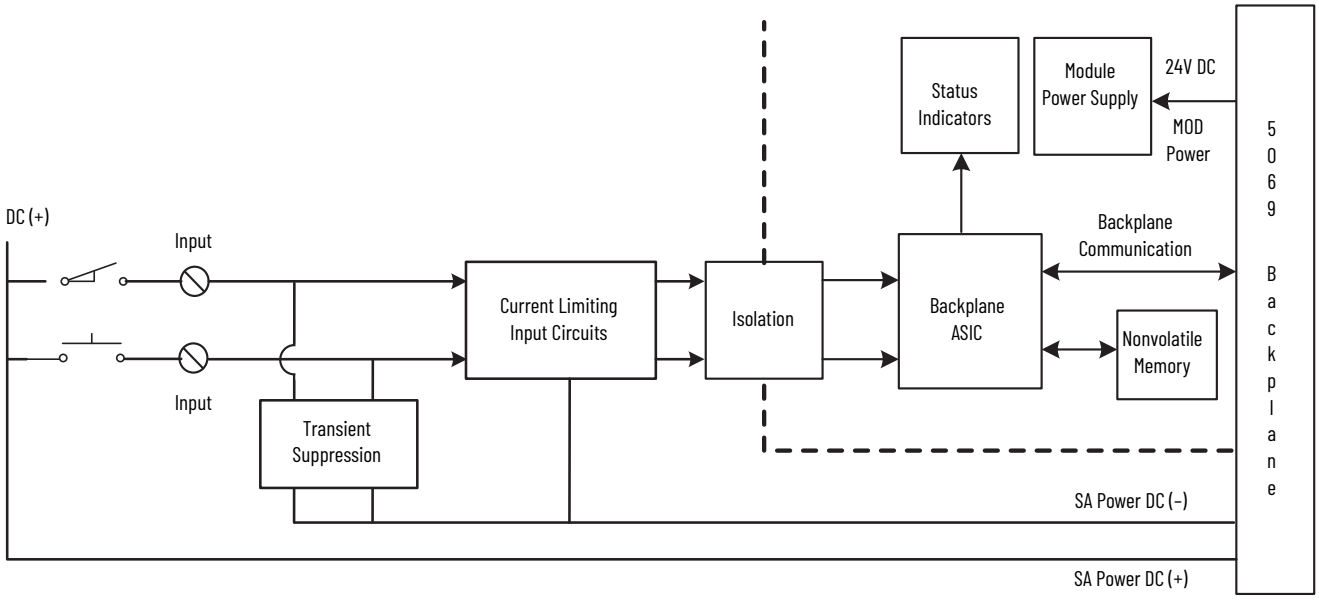
- The 5069-IB16, 5069-IB16K, and 5069-IB16F modules use DC SA power. You must connect DC power to the component, that is, controller, adapter, or field potential distributor, that provides SA Power to the modules.
- The 5069-IB16, 5069-IB16K, and 5069-IB16F module inputs use a shared common. The inputs have a return through internal module circuitry to the SA (–) terminal on the SA Power RTB.
- If you install modules in a system that use AC SA power and DC SA power, you must install them on separate SA power buses.
- You use a 5069-FPD field potential distributor to establish a new SA Power bus in a system. SA Power buses are isolated from each other. To keep the modules on separate SA Power buses, complete these steps.
  1. Install the modules that use one type of SA power, for example DC, to the right of the adapter or controller, that is, the first SA Power bus.
  2. Install the 5069-FPD field potential distributor to establish a second SA Power bus.
  3. Install the modules that use the other type of SA power, for example AC, on the second SA Power bus.

IMPORTANT: The 5069-IB16K and 5069-IB16K modules are wired the same as the wiring diagram that is shown for the 5069-IB16 module.



The following figure shows a functional block diagram for the 5069-IB16, 5069-IB16K, and 5069-IB16F modules.

5069-IB16, 5069-IB16K, and 5069-IB16F Functional Block Diagram



Technical Specifications - 5069-IB16, 5069-IB16K, and 5069-IB16F

Attribute	5069-IB16, 5069-IB16K	5069-IB16F
On-state voltage, min	10V DC	
On-state voltage, nom	24V DC	
On-state voltage, max	32V DC	
On-state current, min	4 mA @ 10V	
On-state current, nom	6 mA @ 24V DC	
On-state current, max	7.4 mA @ 32V DC	
Off-state voltage, max	5V DC	
Off-state current, max	1.5 mA	
Input impedance, min	1.33 kΩ	
Input impedance, nom	4.1 kΩ	
Input impedance, max	7.0 kΩ	
Inrush current, max	< 250 mA peak (decaying to, 37% in 22 ms, without activation)	
Input delay time (screw to backplane)		
Off to On	≤ 100 µs, ±10 µs @ 25 °C (77 °F)	≤ 10 µs, ±1 µs @ 25 °C (77 °F)
On to Off	≤ 100 µs, ±10 µs @ 25 °C (77 °F)	≤ 10 µs, ±1 µs @ 25 °C (77 °F)
Input drift over temperature span	±100 ns/°C (55.6 ns/°F) from 0...60 °C (32...140 °F)	< 10 ns/°C (5.56 ns/°F) from 0...60 °C (32...140 °F)
Input On to Off minimum pulse width	60 µs	6 µs
Input Off to On minimum pulse width	60 µs	6 µs

Technical Specifications - 5069-IB16, 5069-IB16K, and 5069-IB16F

Attribute	5069-IB16, 5069-IB16K	5069-IB16F
Input filter time		
Off to On	Hardware delay: 50 µs + filter time User-selectable filter time: 0...50 ms	Hardware delay: 2 µs + filter time User-selectable filter time: 0...50 ms
On to Off	Hardware delay: 50 µs + filter time User-selectable filter time: 0...50 ms	Hardware delay: 3 µs + filter time User-selectable filter time: 0...50 ms
Reverse polarity protection	Yes	
Overvoltage protection, max	36V (fuse protected)	
Pulse and period measurements	Not supported	±2 µs
Counter frequency	0 - f_{max} = 500 Hz (inv period 2 ms)	0 - f_{max} = 30 kHz (inv period 33.3 µs)
Frequency counter	0 - f_{max} = 500 Hz (inv period 2 ms)	0 - f_{max} = 30 kHz (inv period 33.3 µs)
Timestamp of inputs	Not supported	±10 µs accuracy 1 ns resolution
Overrides	Not supported	
Pulse latching	Not supported	Supported
Events	Not supported	Four events supported (triggered by any input or simple counters)
Pattern matching	Not supported	Supported
Extended counters	Not supported	

General Specifications - 5069-IB16, 5069-IB16K, and 5069-IB16F

Attribute	5069-IB16, 5069-IB16K	5069-IB16F
Inputs	16 Channels (1 group of 16), sinking	
Voltage category	12/24V DC Sink	
Voltage and current ratings		
Input ratings	4...7.4 mA per channel @ 10...32V DC	
MOD Power	75 mA @ 18...32V DC	
MOD Power Passthrough, max[1]	9.55 A @ 18...32V DC	
SA Power	200 mA @ 10...32V DC	
SA Power Passthrough, max[2]	9.95 A @ 10...32V DC	
Power dissipation, max	3.9 W	
Thermal dissipation, max	13.3 BTU/hr	
Isolation voltage	250V (continuous), Basic Insulation Type No isolation between SA Power and input ports No isolation between individual input ports	
Module keying	Electronic keying via programming software	
Indicators	1 green/red module status indicator 16 yellow/red I/O status indicators	
Slot width	1	
Dimensions (HxWxD), approx	144.57 x 22 x 105.42 mm (5.69 x 0.87 x 4.15 in.)	
DIN rail	Compatible zinc-plated chromate-passivated steel DIN rail. You can use the EN50022 - 35 x 7.5 mm (1.38 x 0.30 in.) DIN rail.	

General Specifications - 5069-IB16, 5069-IB16K, and 5069-IB16F

Attribute	5069-IB16, 5069-IB16K	5069-IB16F
RTB	One of these RTB types. • 5069-RTB18-SPRING RTB • 5069-RTB18-SCREW RTB **IMPORTANT**: You must order RTBs separately. RTBs do not ship with Compact 5000 I/O modules. We recommend that you order only the RTB type that your system requires.	
RTB torque (5069-RTB18-SCREW RTB only)	0.4 N·m (3.5 lb·in)	
RTB keying	None	
Wire category(3)	2 - input ports 2 - power ports 1 wire per terminal for each signal port	
Wire size		
5069-RTB18-SPRING connections	0.5…1.5 mm^2 (22…16 AWG) solid or stranded shielded copper wire rated at 105 °C (221 °F), or greater, 2.9 mm (0.11 in.) max diameter including insulation, single wire connection only.	
5069-RTB18-SCREW connections	0.5…1.5 mm^2 (22…16 AWG) solid or stranded shielded copper wire rated at 105 °C (221 °F), or greater, 3.5 mm (0.14 in.) max diameter including insulation, single wire connection only.	
Insulation stripping length	5069-RTB18-SPRING connections: 10 mm (0.39 in.) 5069-RTB18-SCREW connections: 12 mm (0.47 in.)	
Weight, approx	175 g (0.39 lb)	
Enclosure type	None (open-style)	
North American temp code	T4	
ATEX/IECEx temp code	T4	
IECEx temp code	T4	

(1) Level of MOD Power current that passes through the module depends on the system configuration, such as, module slot location and the other module types that are used in the system. For more information, see the CompactLogix 5380 and Compact GuardLogix 5380 Controllers User Manual, 5069-UM001, CompactLogix 5480 Controllers User Manual, 5069-UM002, and Compact 5000 EtherNet/IP Adapters User Manual, 5069-UM004.

(2) Level of SA Power current that passes through the module depends on the system configuration, such as, module slot location and the other module types that are used in the system. For more information, see the CompactLogix 5380 and Compact GuardLogix 5380 Controllers User Manual, 5069-UM001, CompactLogix 5480 Controllers User Manual, 5069-UM002, and Compact 5000 EtherNet/IP Adapters User Manual, 5069-UM004.

(3) Use this Conductor Category information for planning conductor routing. See the Industrial Automation Wiring and Grounding Guidelines, publication 1770-4.1.

Environmental Specifications - 5069-IB16, 5069-IB16K, and 5069-IB16F

Attribute	5069-IB16, 5069-IB16K, 5069-IB16F
Temperature, operating IEC 60068-2-1 (Test Ad, Operating Cold), IEC 60068-2-2 (Test Bd, Operating Dry Heat), IEC 60068-2-14 (Test Nb, Operating Thermal Shock)	0…60 °C (32…140 °F)
Temperature, surrounding air, max	60 °C (140 °F)
Temperature, nonoperating IEC 60068-2-1 (Test Ab, Unpackaged Nonoperating Cold), IEC 60068-2-2 (Test Bb, Unpackaged Nonoperating Dry Heat), IEC 60068-2-14 (Test Na, Unpackaged Nonoperating Thermal Shock)	-40…+85 °C (-40…+185 °F)
Relative humidity IEC 60068-2-30 (Test Db, Unpackaged Damp Heat)	5…95% noncondensing
Vibration IEC 60068-2-6 (Test Fc, Operating)	5 g @ 10…500 Hz

Environmental Specifications - 5069-IB16, 5069-IB16K, and 5069-IB16F

Attribute	5069-IB16, 5069-IB16K, 5069-IB16F
Shock, operating IEC 60068-2-27 (Test Ea, Unpackaged Shock)	30 g
Shock, nonoperating IEC 60068-2-27 (Test Ea, Unpackaged Shock)	50 g
Emissions	IEC 61000-6-4
ESD immunity IEC 61000-4-2	6 kV contact discharges 8 kV air discharges
Radiated RF immunity IEC 61000-4-3	10V/m with 1 kHz sine-wave 80% AM from 80...2000 MHz 10V/m with 200 Hz 50% pulse 100% AM at 900 MHz 10V/m with 200 Hz 50% pulse 100% AM at 1890 MHz 3V/m with 1 kHz sine-wave 80% AM from 2000...2700 MHz
EFT/B immunity IEC 61000-4-4	±4 kV @ 5 kHz on power ports ±3 kV @ 5 kHz on input ports
Surge transient immunity IEC 61000-4-5	±1 kV line-line (DM) and ±2 kV line-earth (CM) on power ports ±1 kV line-line (DM) and ±2 kV line-earth (CM) on input ports
Conducted RF immunity IEC 61000-4-6	10V rms with 1 kHz sine-wave 80% AM from 150 kHz...80 MHz
Voltage variation IEC 61000-4-29	10 ms interruption on MOD Power port

Certifications - 5069-IB16, 5069-IB16K, and 5069-IB16F

Certification[1]	5069-IB16, 5069-IB16K, 5069-IB16F
c-UL-us	UL Listed Industrial Control Equipment, certified for US and Canada. See UL File E65584. UL Listed for Class I, Division 2 Group A,B,C,D Hazardous Locations, certified for U.S. and Canada. See UL File E194810.
CE	European Union 2014/30/EU EMC Directive, compliant with: • EN 61326-1; Meas./Control/Lab., Industrial Requirements • EN 61000-6-2; Industrial Immunity • EN 61000-6-4; Industrial Emissions • EN 61131-2; Programmable Controllers (Clause 8, Zone A & B) European Union 2014/35/EU LVD, compliant with: • EN 61010-2-201; Control Equipment Safety Requirements European Union 2011/65/EU RoHS, compliant with: • EN 50581; Technical documentation
RCM	Australian Radiocommunications Act, compliant with: EN 61000-6-4; Industrial Emissions
Ex	European Union 2014/34/EU ATEX Directive, compliant with: • EN 60079-0; General Requirements • EN 60079-15; Potentially Explosive Atmospheres, Protection "n" • II 3 G Ex nA IIC T4 Gc • DEMKO 15 ATEX 1484X
IECEx	IECEx System, compliant with: • IEC 60079-0; General Requirements • IEC 60079-15; Potentially Explosive Atmospheres, Protection "n" • II 3 G Ex nA IIC T4 Gc • IECEx UL 15.0055X
KC	Korean Registration of Broadcasting and Communications Equipment, compliant with: Article 58-2 of Radio Waves Act, Clause 3
EAC	Russian Customs Union TR CU 020/2011 EMC Technical Regulation Russian Customs Union TR CU 004/2011 LV Technical Regulation

(1) When marked. See the Product Certification link at http://www.ab.com for Declarations of Conformity, Certificates, and other certification details.

5069-OB8 Digital 8-point 24V DC Output Module

The following figure shows a wiring diagram for the 5069-OB8 module.

5069-OB8 Wiring Diagram

Channel Connections

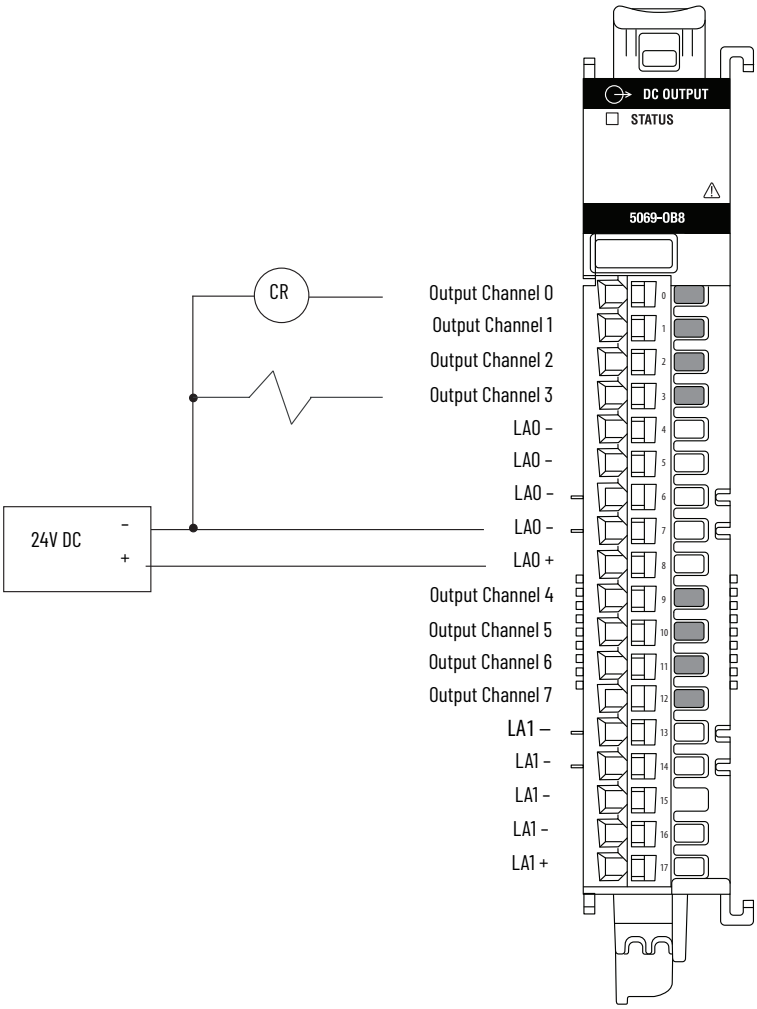
The diagram shows devices that are connected to channels 0 and 3. You are not restricted to using only those channels. You can connect devices to any channel or combination of channels as needed.

LA Power

The Local Actuator (LA+ and LA –) connections are used to supply field-side power to the module.
Output channels 0...3 use LA0 +/–, and output channels 4...7 use LA1 +/–.

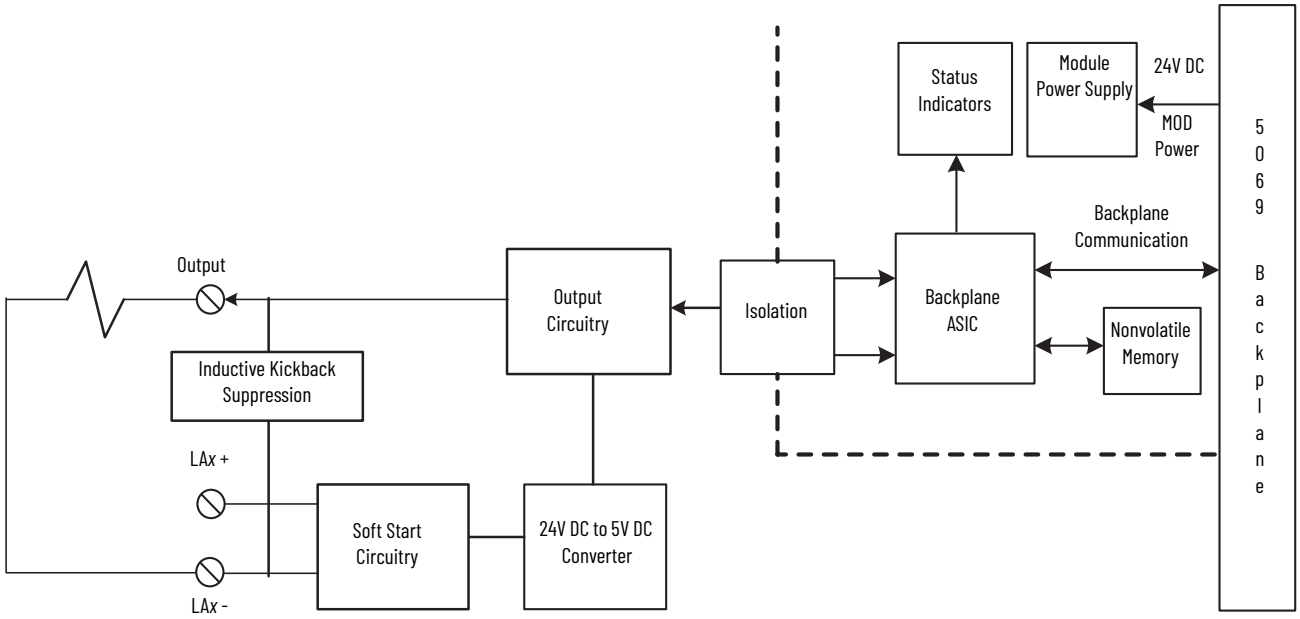
The 5069-OB8 module **does not draw current from the SA power bus**.
Still, the module is a DC-type module, and you must install it on a DC SA Power bus.

- If you install modules in a system that use AC SA power and DC SA power, you must install them on separate SA Power buses.
- You use a 5069-FPD field potential distributor to establish a new SA Power bus in a system. SA Power buses are isolated from each other. To keep the modules on separate SA Power buses, complete these steps.
  1. Install the modules that use one type of SA power, for example DC, to the right of the adapter or controller, that is, the first SA Power bus.
  2. Install the 5069-FPD field potential distributor to establish a second SA Power bus.
  3. Install the modules that use the other type of SA power, for example AC, on the second SA Power bus.



The following figure shows a functional block diagram for the 5069-OB8 module.

5069-OB8 Functional Block Diagram



Technical Specifications - 5069-OB8

Attribute	5069-OB8
On-state voltage, min(1)	10V DC
On-state voltage, nom(1)	24V DC
On-state voltage, max(1)	32V DC
On-state voltage drop, max(1)	0.25V DC
Off-state voltage, max(1)	< 10V DC
Off-state voltage, max(1)	5V DC
On-state current per channel, min(1)	1 mA
Off-state leakage current per point, max(2)	0.5 mA
Output current per channel, max	2 A
Output current per group, max	8 A
Output current per module, max	16 A
Surge current per point	4 A max for 10 ms per point, repeatable every 2 s
Output delay time (backplane to screw)	
Off to On	≤ 100 µs @ 25 °C (77 °F) @ 2 A
On to Off	≤ 100 µs @ 25 °C (77 °F) @ 2 A
Pulse width, min	≤ 200 µs T_{on} min + T_{off} min @ 2 A @ 25 °C (77 °F)
Output drift over temperature span	±100 ns/°C (55.6 n/°F) from 0...60 °C (32...140 °F) @ 2 A
Field power loss detection	Yes
No load detection diagnostics	Yes (per channel diagnostics)
Output short circuit/overload/overtemp detection	Yes (per channel diagnostics)
Output short circuit/overload protection	Yes
Reverse voltage protection	Yes
Overvoltage protection, max	36V (fuse protected)
Pilot duty rating	Resistive/General Pilot Duty 2 A pilot duty
Output control in fault state per point	• Hold Last State • On • Off (default)

Technical Specifications - 5069-OB8

Attribute	5069-OB8
Output states in program mode per point	• Hold Last State • On • Off (default)
Output states in fault mode per point	• Hold Last State • On • Off (default)
Duration of fault mode per point	• 1 s • 2 s • 5 s • 10 s • Forever (default)

(1) Local Actuator (LA) Field Power related attributes.

(2) Recommended Loading Resistor - To limit the effects of leakage current through solid-state outputs, you can connect a loading resistor in parallel with your load. For 24V DC operation, use a 5.6 KΩ, 0.5 W resistor for transistor outputs.

General Specifications - 5069-OB8

Attribute	5069-OB8
Number of outputs	8 (Two groups of 4)
Voltage category	24V DC
Voltage and current ratings	
Output voltage range	10...32V DC
MOD Power	75 mA @ 18...32V DC
MOD Power Passthrough, max(1)	9.55 A @ 18...32V DC
LA Power	2 A per channel @ 10...32V DC 8 A per group @ 10...32V DC 16 A per module @ 10...32V DC
SA Power Passthrough, max(2) The module does not draw SA Power current.	9.95 A @ 10...32V DC
Do not exceed 10 A MOD or SA Power (Passthrough) current draw.	
Power dissipation, max	3.2 W
Thermal dissipation, max	10.9 BTU/hr
Isolation voltage	250V (continuous), Basic Insulation Type Type tested at 1800V AC for 60 s No isolation between LA power and output ports No isolation between individual output ports
Module keying	Electronic keying via programming software
Indicators	1 green/red module status indicator 8 yellow/red I/O status indicators
Slot width	1
Dimensions (HxWxD)	144.57 x 22 x 105.42 mm (5.69 x 0.87 x 4.15 in.)
DIN rail	Compatible zinc-plated chromate-passivated steel DIN rail. You can use the EN50022 - 35 x 7.5 mm (1.38 x 0.30 in.) DIN rail.
RTB	One of these RTB types. • 5069-RTB18-SPRING RTB • 5069-RTB18-SCREW RTB **IMPORTANT**: You must order RTBs separately. RTBs do not ship with Compact 5000 I/O modules. We recommend that you order only the RTB type that your system requires.

General Specifications - 5069-OB8

Attribute	5069-OB8
RTB torque (5069-RTB18-SCREW RTB only)	0.4 N·m (3.5 lb·in)
RTB keying	None
Wire category	2 - output ports 2 - power ports 1 wire per terminal for each signal port
Wire size	
5069-RTB18-SPRING connections	0.5…1.5 mm^2 (22…16 AWG) solid or stranded shielded copper wire rated at 105 °C (221 °F), or greater, 2.9 mm (0.11 in.) max diameter including insulation, single wire connection only.
5069-RTB18-SCREW connections	0.5…1.5 mm^2 (22…16 AWG) solid or stranded shielded copper wire rated at 105 °C (221 °F), or greater, 3.5 mm (0.14 in.) max diameter including insulation, single wire connection only.
Insulation stripping length	
5069-RTB18-SPRING connections	10 mm (0.39 in.)
5069-RTB18-SCREW connections	12 mm (0.47 in.)
RTB torque (5069-RTB18-SCREW RTB only)	0.4 N·m (3.5 lb·in)
Weight, approx	175 g (0.39 lb)
Enclosure type rating	None (open-style)
North American temp code	T4
ATEX temp code	T4
IECEx temp code	T4

(1) Level of MOD Power current that passes through the module depends on the system configuration, such as, module slot location and the other module types that are used in the system. For more information, see the CompactLogix 5380 and Compact GuardLogix 5380 Controllers User Manual, 5069-UM001, CompactLogix 5480 Controllers User Manual, 5069-UM002, and Compact 5000 EtherNet/IP Adapters User Manual, 5069-UM004.

(2) Level of SA Power current that passes through the module depends on the system configuration, such as, module slot location and the other module types that are used in the system. For more information, see the CompactLogix 5380 and Compact GuardLogix 5380 Controllers User Manual, 5069-UM001, CompactLogix 5480 Controllers User Manual, 5069-UM002, and Compact 5000 EtherNet/IP Adapters User Manual, 5069-UM004.

Environmental Specifications - 5069-OB8

Attribute	5069-OB8
Temperature, operating IEC 60068-2-1 (Test Ad, Operating Cold), IEC 60068-2-2 (Test Bd, Operating Dry Heat), IEC 60068-2-14 (Test Nb, Operating Thermal Shock)	0 °C < Ta < +60 °C (+32 °F < Ta < +140 °F)
Temperature, surrounding air, max	60 °C (140 °F)
Temperature, nonoperating IEC 60068-2-1 (Test Ab, Unpackaged Nonoperating Cold), IEC 60068-2-2 (Test Bb, Unpackaged Nonoperating Dry Heat), IEC 60068-2-14 (Test Na, Unpackaged Nonoperating Thermal Shock)	-40…+85 °C (-40…+185 °F)
Relative humidity IEC 60068-2-30 (Test Db, Unpackaged Damp Heat)	5…95% noncondensing
Vibration IEC 60068-2-6 (Test Fc, Operating)	5 g @ 10…500 Hz

Environmental Specifications - 5069-OB8

Attribute	5069-OB8
Shock, operating IEC 60068-2-27 (Test Ea, Unpackaged Shock)	30 g
Shock, nonoperating IEC 60068-2-27 (Test Ea, Unpackaged Shock)	50 g
Emissions	IEC 61000-6-4
ESD immunity IEC 61000-4-2	6 kV contact discharges 8 kV air discharges
Radiated RF immunity IEC 61000-4-3	10V/m with 1 kHz sine-wave 80% AM from 80...2000 MHz 10V/m with 200 Hz 50% pulse 100% AM at 900 MHz 10V/m with 200 Hz 50% pulse 100% AM at 1890 MHz 3V/m with 1 kHz sine-wave 80% AM from 2000...2700 MHz
EFT/B immunity IEC 61000-4-4	±4 kV @ 5 kHz on power ports ±4 kV @ 5 kHz on signal ports
Surge transient immunity IEC 61000-4-5	±1 kV line-line (DM) and ±2 kV line-earth (CM) on power ports ±1 kV line-line (DM) and ±2 kV line-earth (CM) on signal ports
Conducted RF immunity IEC 61000-4-6	10V rms with 1 kHz sine-wave 80% AM from 150 kHz...80 MHz
Corrosion resistance classification	ISA S71.04 G2

Certifications - 5069-OB8

Certification(1)	5069-OB8
c-UL-us	UL Listed Industrial Control Equipment, certified for US and Canada. See UL File E65584. UL Listed for Class I, Division 2 Group A,B,C,D Hazardous Locations, certified for U.S. and Canada. See UL File E194810.
CE	European Union 2014/30/EU EMC Directive, compliant with: • EN 61326-1; Meas./Control/Lab., Industrial Requirements • EN 61000-6-2; Industrial Immunity • EN 61000-6-4; Industrial Emissions • EN 61131-2; Programmable Controllers (Clause 8, Zone A & B) European Union 2014/35/EU LVD, compliant with: • EN 61010-2-201; Control Equipment Safety Requirements European Union 2011/65/EU RoHS, compliant with: • EN 50581; Technical documentation
RCM	Australian Radiocommunications Act, compliant with: EN 61000-6-4; Industrial Emissions
Ex	European Union 2014/34/EU ATEX Directive, compliant with: • EN 60079-0; General Requirements • EN 60079-15; Potentially Explosive Atmospheres, Protection "n" • II 3 G Ex nA IIC T4 Gc • DEMKO 15 ATEX 1484X
IECEx	IECEx System, compliant with: • IEC 60079-0; General Requirements • IEC 60079-15; Potentially Explosive Atmospheres, Protection "n" • II 3 G Ex nA IIC T4 Gc • IECEx UL 15.0055X
KC	Korean Registration of Broadcasting and Communications Equipment, compliant with: Article 58-2 of Radio Waves Act, Clause 3
EAC	Russian Customs Union TR CU 020/2011 EMC Technical Regulation Russian Customs Union TR CU 004/2011 LV Technical Regulation

(1) See the Product Certification link at http://www.ab.com for Declarations of Conformity, Certificates, and other certification details.

SECTION 6.3

PLC

Technical Data

Original Instructions

CompactLogix 5380, Compact GuardLogix 5380, and CompactLogix 5480 Controllers Specifications

Bulletin 5069

Summary of Changes

This publication contains the following new or updated information. This list includes substantive updates only and is not intended to reflect all changes.

Topic	Page
Added CompactLogix™ 5380 Process controllers (5069-L320ERP, 5069-L340ERP).	Throughout
Added I/O Capacity and Message Rate Capacity specifications for controllers.	3, 7, 16

Catalog Numbers

This publication is applicable to these controllers:

CompactLogix 5380 Controller Catalog Numbers	5069-L306ER, 5069-L306ERM, 5069-L310ER, 5069-L310ERM, 5069-L310ER-NSE, 5069-L320ER, 5069-L320ERM, 5069-L320ERMK, 5069-L330ER, 5069-L330ERM, 5069-L330ERMK, 5069-L340ER, 5069-L340ERM, 5069-L350ERM, 5069-L350ERMK, 5069-L380ERM, 5069-L3100ERM
CompactLogix 5380 Process Controller Catalog Numbers	5069-L320ERP, 5069-L340ERP
Compact GuardLogix 5380 SIL 2 Controller Catalog Numbers	5069-L306ERS2, 5069-L306ERMS2, 5069-L310ERS2, 5069-L310ERMS2,5069-L320ERS2, 5069-L320ERS2K, 5069-L320ERMS2, 5069-L320ERMS2K, 5069-L330ERS2, 5069-L330ERS2K, 5069-L330ERMS2, 5069-L330ERMS2K, 5069-L340ERS2, 5069-L340ERMS2, 5069-L350ERS2, 5069-L350ERS2K, 5069-L350ERMS2, 5069-L350ERMS2K, 5069-L380ERS2, 5069-L380ERMS2, 5069-L3100ERS2, 5069-L3100ERMS2
Compact GuardLogix 5380 SIL 3 Controller Catalog Numbers	5069-L306ERMS3, 5069-L310ERMS3, 5069-L320ERMS3, 5069-L320ERMS3K, 5069-L330ERMS3, 5069-L330ERMS3K, 5069-L340ERMS3, 5069-L350ERMS3, 5069-L350ERMS3K, 5069-L380ERMS3, 5069-L3100ERMS3
CompactLogix 5480 Controller Catalog Number	5069-L430ERMW, 5069-L450ERMW, 5069-4100ERMW, 5069-L4200ERMW

CompactLogix 5380 Controllers

CompactLogix™ 5380 controllers are part of the Logix 5000™ family of controllers. The controllers provide a scalable controller solution to address a wide variety of applications. The applications range from standalone systems to more complex systems with devices that are connected to the controller via an EtherNet/IP™ network.

The controllers are mounted on a DIN rail. They can monitor and control local and remote I/O modules, and other devices connected to an EtherNet/IP network. The CompactLogix 5380 controllers support this functionality:

- Use of Compact 5000™ I/O module as local I/O and remote I/O modules.
- Use Compact 5000 I/O modules, and other I/O modules, as remote I/O modules.
- Support for Integrated Motion over an EtherNet/IP network (not all controllers).
- Use of Dual-IP mode or Linear/DLR mode.
- Use of two Ethernet ports that let the controller connect to EtherNet/IP device-level and enterprise-level networks.
- Use of 1784-SD1, 1784-SD2, 1784-SDHC8, 1784-SDHC32, 9509-CMSDCD4 Secure Digital (SD) card for nonvolatile memory.
- USB programming port for temporary connection.
- CompactLogix 5380 Process controllers (5069-L320ERP, 5069-L340ERP) support PlantPAx® 5.0, and are conformal coated to add a layer of protection when exposed to harsh, corrosive environments. For more information, see the PlantPAx DCS Configuration and Implementation User Manual, publication PROCES-UM100.

Features - CompactLogix 5380 Controllers

Feature	5069-L306ER, 5069-L306ERM	5069-L310ER, 5069-L310ER-NSE, 5069-L310ERM	5069-L320ER, 5069-L320ERM, 5069-L320ERMK, 5069-L320ERP	5069-L330ER, 5069-L330ERM, 5069-L330ERMK	5069-L340ER, 5069-L340ERM, 5069-L340ERP	5069-L350ERM, 5069-L350ERMK	5069-L380ERM	5069-L3100ERM
Controller tasks Continuous Periodic Event	32 tasks 1000 programs/task All event triggers							
Built-in communication ports	1 - USB port 2 - Ethernet ports **IMPORTANT**: Consider the following: When the controller operates in Dual-IP mode, each Ethernet port requires a unique IP address. When the controller operates in Linear/DLR mode, the controller uses only one IP address.							
USB port communication	USB 2.0, Type B Full speed (12 Mbps) Programming, configuration, firmware update, and online edits only							
Ethernet performance	10 Mbps, 100 Mbps, 1 Gbps Full-duplex only							
I/O Capacity (Class 0/1) (1)	128,000 packets/second							
Message Rate Capacity HMI/MSG (Class 3) (1)	2000 messages/second							
EtherNet/IP modes supported	Dual-IP mode (Available with the Studio 5000 Logix Designer® application, version 29.00.00 or later) Linear/DLR mode							
EtherNet/IP network topologies supported	DLR Star Linear							
EtherNet/IP nodes supported, max (2)	16	24	40	60	90	120	150	180
Socket interfaces supported, max	32							
Integrated motion (3)	5069-L306ERM	5069-L310ERM	5069-L320ERM, 5069-L320ERMK, 5069-L320ERP	5069-L330ERM, 5069-L330ERMK	5069-L340ERM, 5069-L340ERP	5069-L350ERM, 5069-L350ERMK	5069-L380ERM	5069-L3100ERM

Features - CompactLogix 5380 Controllers (Continued)

Feature	5069-L306ER, 5069-L306ERM	5069-L310ER, 5069-L310ER-NSE, 5069-L310ERM	5069-L320ER, 5069-L320ERM, 5069-L320ERMK, 5069-L320ERP	5069-L330ER, 5069-L330ERM, 5069-L330ERMK	5069-L340ER, 5069-L340ERM, 5069-L340ERP	5069-L350ERM, 5069-L350ERMK	5069-L380ERM	5069-L3100ERM
Number of axes supported, max(4)	256							
Number of CIP™ Drive axes (Position loop-configured) supported, max(5)	5069-L306ERM: 2	5069-L310ERM: 4	5069-L320ERM, 5069-L320ERMK, 5069-L320ERP: 8	5069-L330ERM, 5069-L330ERMK: 16	5069-L340ERM, 5069-L340ERP: 20	24	28	32
Programming languages	Ladder Diagram (LD) Structured Text (ST) Function Block Diagram (FBD) Sequential Function Chart (SFC)							

(1) I/O numbers are maximums; they assume no HMI/MSG. HMI/MSG numbers are maximums, they assume no I/O. Maximums assume the processor is target, not originator. Packet rates vary depending on packet size. For more details, see Troubleshoot EtherNet/IP Application Technique, publication ENET-AT003, and the EDS file for a specific catalog number.

(2) The maximum number of nodes that are listed represents when the controller is used with the Logix Designer application, version 31 or later. Some controllers can be used with earlier Logix Designer application versions. The maximum number of nodes that a controller supports can be fewer in Logix Designer application, versions 30 or earlier.

(3) Only CompactLogix 5380 controllers that have an M or P in their catalog number support Integrated Motion on EtherNet/IP networks.

(4) Any combination of CIP Drive, Virtual, Consumed, Regenerative AC/DC Converter and Non-Regenerative AC/DC Converter axis types.

(5) The maximum number of CIP Drive axes (configured for Position Loop) that can be included in the total integrated motion axes count for a controller.

Technical Specifications - CompactLogix 5380 Controllers

Attribute	5069-L306ER, 5069-L306ERM	5069-L310ER, 5069-L310ER-NSE, 5069-L310ERM	5069-L320ER, 5069-L320ERM, 5069-L320ERMK, 5069-L320ERP	5069-L330ER, 5069-L330ERM, 5069-L330ERMK	5069-L340ER, 5069-L340ERM, 5069-L340ERP	5069-L350ERM, 5069-L350ERMK	5069-L380ERM	5069-L3100ERM
User memory	0.6 MB	1 MB	2 MB	3 MB	4 MB	5 MB	8 MB	10 MB
Optional nonvolatile memory	• 1784-SD1 (1 GB) • 1784-SD2 (2 GB), ships with controller • 1784-SDHC8 (8 GB) • 1784-SDHC32 (32 GB) • 9509-CMSDCD4 (4 GB) CodeMeter CmCard card							
Local I/O modules, max	8	8	16	31(1)	31	31	31	31
MOD Power voltage range	18...32V DC							
MOD Power current, max	450 mA							
MOD Power inrush	850 mA for 125 ms							
MOD Power passthrough(2)	9.55 A @ 18...32V DC							
MOD Power current rating, max	10 A Do not exceed 10 A current draw at the MOD Power RTB.							
SA Power voltage ranges(3)	0...32V DC 0...240V AC, 47...63 Hz ATEX/IECEX, 125V AC max							
SA Power current, max(3)	10 mA (DC power) 25 mA (AC power)							
SA Power passthrough(3), (4)	9.95 A @ 0...32V DC 9.975 A @ 0...240V AC, 47...63 Hz ATEX/IECEX, 125V AC max							
SA Power current rating, max (3)	10 A (AC or DC power) Do not exceed 10 A current draw at the SA Power RTB.							
Power dissipation, max	8.5 W							
Thermal dissipation, max	29 BTU/hr							
Isolation voltage	300V (continuous), Basic Insulation Type, SA, and MOD Power to Backplane 300V (continuous), Basic Insulation Type, SA to MOD Power 300V (continuous), Basic Insulation Type, Ethernet to Backplane 300V (continuous), Double Insulation Type, Ethernet to MOD Power 300V (continuous), Double Insulation Type, Ethernet to SA Power 50V (continuous), Functional Insulation Type, Ethernet to USB 300V (continuous), Basic Insulation Type, USB to Backplane 300V (continuous), Double Insulation Type, USB to MOD Power 300V (continuous), Double Insulation Type, USB to SA Power No isolation between Ethernet ports Type tested at 1500V AC for 60 s							
Weight, approx	0.768 kg (1.693 lb)							

Technical Specifications - CompactLogix 5380 Controllers (Continued)

Attribute	5069-L306ER, 5069-L306ERM	5069-L310ER, 5069-L310ER-NSE, 5069-L310ERM	5069-L320ER, 5069-L320ERM, 5069-L320ERMK, 5069-L320ERP	5069-L330ER, 5069-L330ERM, 5069-L330ERMK	5069-L340ER, 5069-L340ERM, 5069-L340ERP	5069-L350ERM, 5069-L350ERMK	5069-L380ERM	5069-L3100ERM
Dimensions (HxWxD), approx	143.97 x 98.10 x 136.81 mm (5.67 x 3.86 x 5.39 in.)							
Location	DIN rail mount (horizontal mount only)							
DIN rail	Compatible zinc-plated, chromate steel DIN rail. EN50022 - 35 x 7.5 mm (1.38 x 0.30 in.)							
Removable terminal block	RTBs are available in separately ordered 5069 RTB kits. The MOD power connection uses a 4-point RTB, and the SA power connection uses a 6-point RTB. The following kits are available: • Kit catalog number 5069-RTB64-SCREW contains RTB catalog numbers 5069-RTB6-SCREW and 5069-RTB4-SCREW. • Kit catalog number 5069-RTB64-SPRING contains RTB catalog numbers 5069-RTB6-SPRING and 5069-RTB4-SPRING.							
Terminal block torque	5069-RTB4-SCREW & 5069-RTB6-SCREW: 0.4 N•m (3.5 lb•in) 5069-RTB4-SPRING & 5069-RTB6-SPRING: Torque does not apply							
Wire size	5069-RTB4-SCREW, 5069-RTB6-SCREW connections: 0.5…1.5 mm^2 (22…16 AWG) solid or stranded copper wire that is rated at 105 °C (221 °F), or greater, 3.5 mm (0.14 in.) max diameter including insulation, single wire connection only 5069-RTB4-SPRING, 5069-RTB6-SPRING connections: 0.5…1.5 mm^2 (22…16 AWG) solid or stranded copper wire that is rated at 105 °C (221 °F), or greater, 2.9 mm (0.11 in.) max diameter including insulation, single wire connection only Ethernet connections: Ethernet Cabling and Installation according to IEC 61918 and IEC 61784-5-2							
Insulation stripping length	5069-RTB4-SCREW, 5069-RTB6-SCREW connections: 12 mm (0.47 in.) 5069-RTB4-SPRING, 5069-RTB6-SPRING connections: 10 mm (0.39 in.)							
Wire category(5)	3 - on USB port 1 - on power ports 2 - on Ethernet ports							
Enclosure	None (open-style)							
North American temperature code	T4							
ATEX temperature code	T4							
IECEx temperature code	T4							

(1) When you use these controllers with the Studio 5000 Logix Designer application, version 29.00.00, the application limits the number of local I/O modules in the project to 16. For more information, see the Rockwell Automation Knowledgebase article #942580, '5380 CompactLogix controllers limited to 16 local 5069 modules in version 29 of Studio 5000® environment.The document is available at http://www.rockwellautomation.com/knowledgebase.
With the Logix Designer application, version 30.00.00 or later, the controllers support as many as 31 local I/O modules.

(2) Maximum level of MOD Power current that the controller can pass through to the next module in the system. The specific level of current passed through varies based on system configuration.

(3) SA power specifications are based on the number and type of Compact 5000 I/O modules that are used in the system. If the set of I/O modules that are used in the system require AC and DC voltage, you must install a 5069-FPD field potential distributor to separate the module types.

(4) Maximum level of SA Power current that the controller can pass through to the next module in the system. The specific level of current passed through varies based on system configuration.

(5) Use this Conductor Category information for planning conductor routing. See the Industrial Automation Wiring and Grounding Guidelines, publication 1770-4.1.

Environmental Specifications - CompactLogix 5380 Controllers

Attribute	5069-L306ER, 5069-L306ERM, 5069-L310ER, 5069-L310ER-NSE, 5069-L310ERM, 5069-L320ER, 5069-L320ERM, 5069-L320ERMK, 5069-L320ERP, 5069-L330ER, 5069-L330ERM, 5069-L330ERMK, 5069-L340ER, 5069-L340ERM, 5069-L340ERP, 5069-L350ERM, 5069-L350ERMK, 5069-L380ERM, 5069-L3100ERM
Temperature, operating IEC 60068-2-1 (Test Ad, Operating Cold), IEC 60068-2-2 (Test Bd, Operating Dry Heat), IEC 60068-2-14 (Test Nb, Operating Thermal Shock)	0 °C < Ta < +60 °C (+32 °F <Ta < +140 °F)
Temperature, nonoperating IEC 60068-2-1 (Test Ab, Unpackaged Nonoperating Cold), IEC 60068-2-2 (Test Bb, Unpackaged Nonoperating Dry Heat), IEC 60068-2-14 (Test Na, Unpackaged Nonoperating Thermal Shock)	-40…+85 °C (-40…+185 °F)
Temperature, surrounding air, max	60 °C (140 °F)
Relative humidity IEC 60068-2-30 (Test Db, Unpackaged Damp Heat)	5…95% noncondensing
Vibration IEC 60068-2-6 (Test Fc, Operating)	5 g @ 10…500 Hz
Shock, operating IEC 60068-2-27 (Test Ea, Unpackaged Shock)	30 g
Shock, nonoperating IEC 60068-2-27 (Test Ea, Unpackaged Shock)	50 g
Emissions	IEC 61000-6-4

Environmental Specifications - CompactLogix 5380 Controllers (Continued)

Attribute	5069-L306ER, 5069-L306ERM, 5069-L310ER, 5069-L310ER-NSE, 5069-L310ERM, 5069-L320ER, 5069-L320ERM, 5069-L320ERMK, 5069-L320ERP, 5069-L330ER, 5069-L330ERM, 5069-L330ERMK, 5069-L340ER, 5069-L340ERM, 5069-L340ERP, 5069-L350ERM, 5069-L350ERMK, 5069-L380ERM, 5069-L3100ERM
ESD immunity IEC 61000-4-2	6 kV contact discharges 8 kV air discharges
Radiated RF immunity IEC 61000-4-3	10V/m with 1 kHz sine-wave 80% AM from 80...2000 MHz 10V/m with 200 Hz 50% Pulse 100% AM @ 900 MHz 10V/m with 200 Hz 50% Pulse 100% AM @ 1890 MHz 3V/m with 1 kHz sine-wave 80% AM from 2000...2700 MHz
EFT/B immunity IEC 61000-4-4	± 4 kV at 5 kHz on power ports ± 2 kV at 5 kHz on Ethernet ports
Surge transient immunity IEC 61000-4-5	± 1 kV line-line (DM) and ± 2 kV line-earth (CM) on power ports ± 2 kV line-earth (CM) on Ethernet ports
Conducted RF immunity IEC 61000-4-6	10V rms with 1 kHz sine-wave 80% AM from 150 kHz...80 MHz
Voltage variation IEC 61000-4-29	10 ms interruption on MOD Power port

Certifications - CompactLogix 5380 Controllers

Certification[1]	5069-L306ER, 5069-L306ERM, 5069-L310ER, 5069-L310ER-NSE, 5069-L310ERM, 5069-L320ER, 5069-L320ERM, 5069-L320ERMK, 5069-L320ERP, 5069-L330ER, 5069-L330ERM, 5069-L330ERMK, 5069-L340ER, 5069-L340ERM, 5069-L340ERP, 5069-L350ERM, 5069-L350ERMK, 5069-L380ERM, 5069-L3100ERM
c-UL-us	UL Listed Industrial Control Equipment, certified for US and Canada. See UL File E65584. UL Listed for Class I, Division 2 Group A,B,C,D Hazardous Locations, certified for U.S. and Canada. See UL File E194810.
CE	European Union 2014/30/EU EMC Directive, compliant with: • EN 61326-1; Meas./Control/Lab., Industrial Requirements • EN 61000-6-2; Industrial Immunity • EN 61000-6-4; Industrial Emissions • EN 61131-2; Programmable Controllers (Clause 8, Zone A & B) European Union 2014/35/EU LVD, compliant with: • EN 61010-2-201; Control Equipment Safety Requirements European Union 2011/65/EU RoHS, compliant with: • EN 50581; Technical documentation
RCM	Australian Radiocommunications Act, compliant with: • EN 61000-6-4; Industrial Emissions
Ex	European Union 2014/34/EU ATEX Directive, compliant with: • EN 60079-0; General Requirements • EN 60079-15; Potentially Explosive Atmospheres, Protection "n" • II 3 G Ex nA IIC T4 Gc • DEMKO 15 ATEX 1455X when used at or below 125V AC
IECEx	IECEx System, compliant with: • IEC 600079-0: General Requirements • IEC 60079-15; Potentially Explosive Atmospheres, Protection "n" • II 3 G Ex nA IIC T4 Gc • IECEx UL 15.0007X when used at or below 125V AC
KC	Korean Registration of Broadcasting and Communications Equipment, compliant with: • Article 58-2 of Radio Waves Act, Clause 3 **IMPORTANT**: This certification does not apply to the following catalog numbers: 5069-L320ERMK, 5069-L330ERMK, 5069-L350ERMK
EAC	Russian Customs Union TR CU 020/2011 EMC Technical Regulation
EtherNet/IP	ODVA conformance tested to EtherNet/IP specifications

(1) See the Product Certification link at http://www.ab.com for Declarations of Conformity, Certificates, and other certification details.

Controller Minimum Spacing Requirements

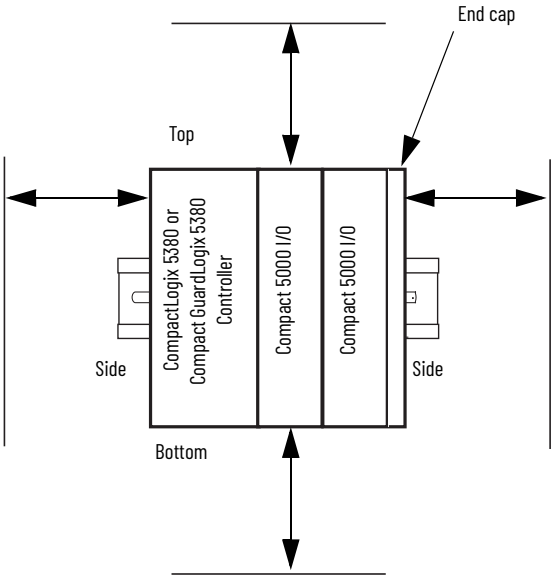
The minimum distance between the CompactLogix 5380 system or Compact GuardLogix 5380 system and enclosure walls, wireways, and adjacent equipment varies based on the current operating temperature.

The minimum distances on all sides of the system are as follows:

- **CompactLogix 5380 Standard and Process Controllers**
  - 50.80 mm (2.00 in.) at 55 °C (131 °F)
  - 101.60 mm (4.00 in) at 60 °C (140 °F)
- **Compact GuardLogix 5380 SIL 2 Controller**

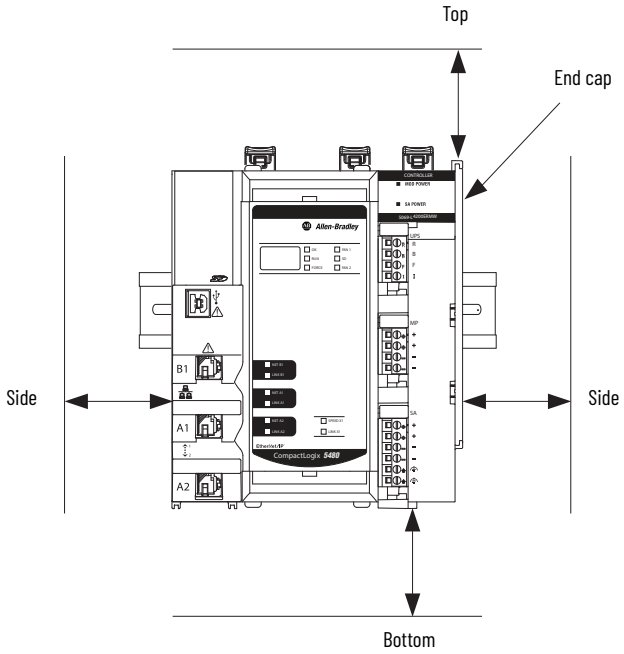
  Series A catalog numbers:
  - 50.8 mm (2.00 in.) at 50 °C (122 °F)
  - 101.6 mm (4.00 in.) at 55 °C (131 °F)
  - 152.4 mm (6.00 in) at 60 °C (140 °F)

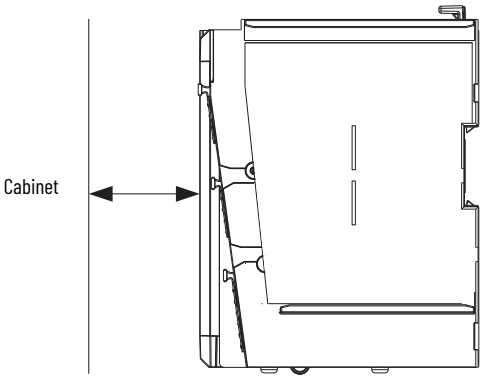
  Series B catalog numbers:
  - 50.8 mm (2.00 in.) at 55 °C (131 °F)
  - 101.6 mm (4.00 in.) at 60 °C (140 °F)
- **Compact GuardLogix 5380 SIL 3 Controller**
  - 50.8 mm (2.00 in.) at 55 °C (131 °F)
  - 101.6 mm (4.00 in.) at 60 °C (140 °F)



The minimum distance on of a system that includes only a CompactLogix 5480 controller is as follows:

- 25.00 mm (0.98 in.) between the sides and the cabinet
- 25.00 mm (0.98 in.) between the front of the controller and the cabinet
- 50.00 mm (1.96 in.) between the top and bottom and the cabinet
  We recommend that you install the controller near the bottom of the enclosure, where ambient temperature is lower.



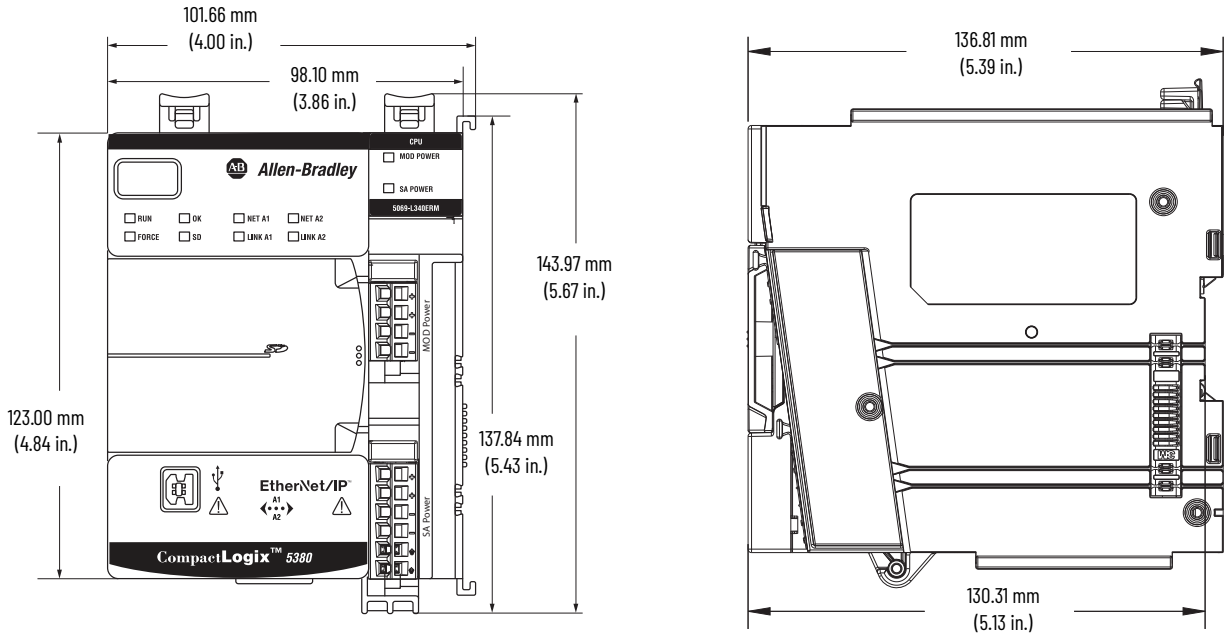


IMPORTANT If Compact 5000 I/O modules are installed next to a CompactLogix 5380, Compact GuardLogix 5380, or CompactLogix 5480 controller, you must mount the system horizontally.

You mount CompactLogix 5480 controllers in any orientation if there are no Compact 5000 I/O modules installed next to the controller.

Controller Dimensions

CompactLogix 5380



Controller Use with Other Devices

Your controller can control and communicate with the following devices:

- Control I/O Modules
- Communicate with Display Devices
- Communicate with Other Controllers

Control I/O Modules

The CompactLogix 5380 and Compact GuardLogix 5380 controllers can monitor and control local and remote I/O modules.

Local I/O Modules

- A CompactLogix 5380 and CompactLogix 5480 system supports Compact 5000 I/O standard modules as local I/O modules.
- A Compact GuardLogix 5380 system supports Compact 5000 I/O standard and safety modules as local modules.

The number of local I/O modules that are supported in a CompactLogix 5380 system or Compact GuardLogix 5380 system varies by controller catalog number.

Cat. No.	Local Compact 5000 I/O Modules Supported, Max	
	Standard I/O Modules	Any Combination of Standard and Safety I/O Modules
5069-L306ER, 5069-L306ERM	8	—
5069-L306ERS2, 5069-L306ERMS2, 5069-L306ERMS3		8
5069-L310ER, 5069-L310ER-NSE, 5069-L310ERM	8	—
5069-L310ERS2, 5069-L310ERMS2, 5069-L310ERMS3		8
5069-L320ER, 5069-L320ERM, 5069-L320ERMK, 5069-L320ERP	16	—
5069-L320ERS2, 5069-L320ERMS2, 5069-L320ERS2K, 5069-L320ERMS2K, 5069-L320ERMS3, 5069-L320ERMS3K		16
5069-L330ER, 5069-L330ERM(1), 5069-L330ERMK(1)	31	—
5069-L330ERS2, 5069-L330ERMS2, 5069-L330ERS2K, 5069-L330ERMS2K, 5069-L330ERMS3, 5069-L330ERMS3K		31
5069-L340ER, 5069-L340ERM, 5069-L340ERP	31	—
5069-L340ERS2, 5069-L340ERMS2, 5069-L340ERMS3		31
5069-L350ERM, 5069-L350ERMK	31	—
5069-L350ERS2, 5069-L350ERMS2, 5069-L350ERS2K, 5069-L350ERMS2K, 5069-L350ERMS3, 5069-L350ERMS3K		31
5069-L380ERM	31	—
5069-L380ERS2, 5069-L380ERMS2, 5069-L380ERMS3		31
5069-L3100ERM	31	—
5069-L3100ERS2, 5069-L3100ERMS2, 5069-L3100ERMS3		31
5069-L430ERMW, 5069-L450ERMW, 5069-4100ERMW, 5069-L4200ERMW	31	—

(1) When you use these controllers with the Logix Designer application, version 29.00.00, the application limits the number of local I/O modules in the project to 16. For more information, see the Rockwell Automation Knowledgebase article #942580, '5380 CompactLogix controllers limited to 16 local 5069 modules in version 29 of Studio 5000®.' The document is available at http://www.rockwellautomation.com/knowledgebase. With the Logix Designer application, version 30.00.00 or later, the controllers support 31 local I/O modules.

Remote I/O Modules

The controllers can connect to these remote I/O modules over an EtherNet/IP network.

IMPORTANT For maximum performance, we recommend that you use Compact 5000 I/O modules when you use remote I/O modules.

CompactLogix 5380 controllers, Compact GuardLogix 5380, and CompactLogix 5480 controllers support the remote I/O modules in this table. The I/O modules that are listed are **standard I/O modules**.

Module Type	I/O Module Family
Chassis-based I/O	1746 SLC™ I/O
	1756 ControlLogix® I/O
	1769 Compact I/O™
	Compact 5000 I/O standard modules
In-cabinet I/O	1734 POINT I/O™
	1794 FLEX™ I/O
On-Machine™ I/O	1732 ArmorBlock® I/O
	1738 ArmorPOINT® I/O

Only Compact GuardLogix 5380 controllers support the remote I/O modules in this table. The I/O modules that are listed are **safety I/O modules**.

Module Type	I/O Module Family
Chassis-based I/O	Compact 5000 I/O safety modules
	1756 ControlLogix Safety I/O
In-cabinet I/O	CompactBlock™ Guard I/O™
	POINT Guard I/O™
On-Machine™ I/O	1732 ArmorBlock® Guard I/O™

Communicate with Display Devices

The controller can communicate with these display devices over an EtherNet/IP network.

Device Type	Display
Industrial computers	Allen-Bradley® integrated-display rotating media (HDD) and solid-state (SSD) computers
	Allen-Bradley integrated-display computers with keypad
	Allen-Bradley non-display computers
Graphic terminals	PanelView™ Plus and PanelView CE terminals
	PanelView standard terminals
Message displays	InView™ message displays

Communicate with Other Controllers

The controller can communicate with these programmable controllers.

Controller Type	Controller Family
Programmable automation controller	CompactLogix 5370
	CompactLogix 5380
	CompactLogix 5480
	Compact GuardLogix 5370 (safety)
	Compact GuardLogix 5380 (safety)
	ControlLogix 5570
	ControlLogix 5580
	GuardLogix 5570 (safety)
	GuardLogix 5580 (safety)
	1756 Armor™ ContrlLogix (safety)
	1756 Armor™ GuardLogix® (safety)
	1768 Compact GuardLogix (safety)
	1768 CompactLogix
	1769 Modular CompactLogix
	1769 Packaged CompactLogix
Programmable logic controllers	1789 SoftLogix™ 5800
	PowerFlex® with DriveLogix™
	1785 PLC-5®(1)
	1747 SLC™(1)
	1761 MicroLogix™(2)
	1762 MicroLogix(2)
	1763 MicroLogix
	1764 MicroLogix(2)
	1766 MicroLogix

(1) These controllers require a built-in Ethernet port or a 1761-NET-ENI, EtherNet/IP RS-232-C interface to communicate with a CompactLogix 5380 controller over an EtherNet/IP network.

(2) These controllers require a 1761-NET-ENI, EtherNet/IP RS-232-C interface to communicate with a CompactLogix 5380 controller over an EtherNet/IP network.

Ethernet Node Limits

When you configure a CompactLogix 5380, Compact GuardLogix 5380, or CompactLogix 5480 control system, consider the number of Ethernet nodes that are used. The number of Ethernet nodes that you can include in the I/O configuration section in the Logix Designer application project is limited.

Maximum Number of Ethernet Nodes

The number of nodes that are supported in a Logix Designer application project varies by CompactLogix 5380, Compact GuardLogix 5380, and CompactLogix 5480 controller.

The maximum number of nodes that are listed represents when the controller is used with the Logix Designer application, version 31 or later. You can use CompactLogix 5380 controllers with earlier Logix Designer application versions. The maximum number of nodes that a controller supports can be fewer in Logix Designer application, versions 30 or earlier.

Cat. No.	Ethernet Nodes Supported
5069-L306ER, 5069-L306ERM, 5069-L306ERS2, 5069-L306ERMS2, 5069-L306ERMS3	16
5069-L310ER, 5069-L310ER-NSE, 5069-L310ERM, 5069-L310ERS2, 5069-L310ERMS2, 5069-L310ERMS3	24
5069-L320ER, 5069-L320ERM, 5069-L320ERMK, 5069-L320ERP 5069-L320ERS2, 5069-L320ERMS2, 5069-L320ERS2K, 5069-L320ERMS2K, 5069-L320ERMS3, 5069-L320ERMS3K	40
5069-L330ER, 5069-L330ERM, 5069-L330ERMK, 5069-L330ERS2, 5069-L330ERMS2, 5069-L330ERS2K, 5069-L330ERMS2K, 5069-L330ERMS3, 5069-L330ERMS3K	60
5069-L340ER, 5069-L340ERM, 5069-L340ERP 5069-L340ERS2, 5069-L340ERMS2, 5069-L340ERMS3	90
5069-L350ERM, 5069-L350ERMK, 5069-L350ERS2, 5069-L350ERMS2, 5069-L350ERS2K, 5069-L350ERMS2K	120
5069-L380ERM, 5069-L380ERS2, 5069-L380ERMS2, 5069-L380ERMS3	150
5069-L3100ERM, 5069-L3100ERS2, 5069-L3100ERMS2, 5069-L3100ERMS3	180
5069-L430ERMW	60
5069-L450ERMW	120
5069-4100ERMW	180
5069-L4200ERMW	250

Any devices that you add directly to the I/O configuration section are counted toward the Ethernet node limit. The following are examples of devices that must be counted:

- Remote communication adapters
- Devices with an embedded Ethernet port, such as I/O modules, drives, and linking devices
- Remote controllers when a produce/consume connection is established between the two controllers
- HMI devices that are included in the I/O configuration tree
- Third-party devices that are directly connected to the EtherNet/IP network

Additional Resources

These documents contain additional information concerning related products from Rockwell Automation.

Resource	Description
CompactLogix Controllers Selection Guide, publication 1769-SG001	Describes how to design and select components for your CompactLogix™ controller system.
CompactLogix 5380 and Compact GuardLogix Controllers User Manual, publication 5069-UM001	Describes how to use CompactLogix 5380 and Compact GuardLogix® 5380 controllers.
CompactLogix 5480 Controllers User Manual, publication 5069-UM002	Describes how to use CompactLogix 5480 controllers.
Compact 5000 I/O Modules and EtherNet/IP Adapters Specifications Technical Data, publication 5069-TD001	Provides specifications, wiring diagrams, and functional block diagrams for Compact 5000™ I/O modules and EtherNet/IP™ adapters.
Compact 5000 I/O Digital Modules User Manual, publication 5069-UM004	Describes how to configure and operate Compact 5000 I/O digital and safety modules.
Compact 5000 I/O Analog Modules User Manual, publication 5069-UM005	Describes how to configure and operate Compact 5000 I/O analog modules.
Compact 5000 I/O High-speed Counter Module User Manual, publication 5069-UM006	Describes how to configure and operate a Compact 5000 I/O high-speed counter module.
Replacement Guidelines: Logix 5000 Controllers Reference Manual, publication 1756-RM100	Describes how to replace the following: ControlLogix® 5560/5570 controller with a ControlLogix 5580 controller CompactLogix 5370 L3 controllers with a CompactLogix 5380 controller
Compact 5000 EtherNet/IP Adapters User Manual, publication 5069-UM007	Describes how to use Compact 5000 I/O and FLEX 5000™ I/O EtherNet/IP communication modules.
Integrated Architecture and CIP Sync Configuration Application Technique, publication IA-AT003	Provides information on CIP Sync™ and the IEEE 1588-2008 Precision Time Protocol.
Integrated Architecture Tools website, http://www.rockwellautomation.com/global/products-technologies/integrated-architecture/tools/overview.page	Provides information on tools that you can use in the selection, development, commissioning, and maintenance stages of the Integrated Architecture® lifecycle.
Industrial Automation Wiring and Grounding Guidelines, publication 1770-4.1	Provides general guidelines for installing a Rockwell Automation industrial system.
Product Certifications website, rok.auto/certifications.	Provides declarations of conformity, certificates, and other certification details.

You can view or download publications at rok.auto/literature.

Rockwell Automation Support

Use these resources to access support information.

Technical Support Center	Find help with how-to videos, FAQs, chat, user forums, and product notification updates.	rok.auto/support
Knowledgebase	Access Knowledgebase articles.	rok.auto/knowledgebase
Local Technical Support Phone Numbers	Locate the telephone number for your country.	rok.auto/phonesupport
Literature Library	Find installation instructions, manuals, brochures, and technical data publications.	rok.auto/literature
Product Compatibility and Download Center (PCDC)	Get help determining how products interact, check features and capabilities, and find associated firmware.	rok.auto/pcdc

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EUROPE/MIDDLE EAST/AFRICA: Rockwell Automation NV, Pegasus Park, De Kleetlaan 12a, 1831 Diegem, Belgium, Tel: (32) 2 663 0600, Fax: (32) 2 663 0640
ASIA PACIFIC: Rockwell Automation, Level 14, Core F, Cyberport 3, 100 Cyberport Road, Hong Kong, Tel: (852) 2887 4788, Fax: (852) 2508 1846

Publication 5069-TD002J-EN-P - August 2020
Supersedes Publication 5069-TD002I-EN-P - May 2020

SECTION 6.4

PLC POWER SUPPLY

Lone Star Blower
8883 West Monroe
Houston, TX 77061

PH: 832-532-3112
FAX: 832-532-3115

TRIO-PS-2G/1AC/24DC/20

Power supply unit

Data sheet
105902_en_00

1 Description

TRIO POWER - power supplies with standard functionality
The power supplies of the TRIO POWER family convince due to their slim and robust design. The dynamic boost (1.5 x I_N for 5 seconds) absorbs starting currents and short overload situations securely during operation and without a drop in output voltage. The push-in connection technology on the front enables fast and tool-free wiring of the devices.

Features

- Especially slim design
- Worldwide use, thanks to wide-range input
- Safe operation, thanks to electrically and mechanically robust design
- Reliable starting of heavy loads, thanks to dynamic boost (1.5 x I_N for 5 seconds)
- Simplified error diagnostics for remote signaling via DC-OK signal contact
- OVP (Over Voltage Protection) limits surge voltages to ≤ 30 V (EN61131-2)
- Tool-free connection via push-in connection technology

Technical data (short form)	
Nominal input voltage range	100 V AC ... 240 V AC 110 V DC ... 250 V DC
Frequency range	50 Hz ... 60 Hz
Nominal output voltage > 24 V DC, constant capacity restricted	24 V DC ±1 % 24 V DC ... 28 V DC
Nominal output current I_N / I_{Dyn}	20 A / 30 A (5 s)
Residual ripple	≤ 30 mV_{PP}
Protection against surge voltage on the output	≤ 30 V DC
MTBF (IEC 61709, SN 29500)	> 1800000 h (25 °C) > 1000000 h (40°C) > 480000 h (60°C)
Efficiency for 230 V AC and nominal values	> 93 %
Maximum power dissipation NO-Load	< 5.7 W
Power loss nominal load max.	< 44 W
Ambient temperature (operation)	-25 °C ... 70 °C > 60 °C Derating: 2,5 %/K
Ambient temperature (start-up type tested)	-40 °C
Weight	1.5 kg
Dimensions W/H/D	68 mm / 130 mm / 160 mm

Make sure you always use the latest documentation.
It can be downloaded from the product at phoenixcontact.net/products.

2 Table of contents

3 Ordering data

Description	Type	Order No.	Pcs./Pkt.
Primary-switched TRIO POWER power supply with push-in connection for DIN rail mounting, input: single-phase, output: 24 V DC/20 A	TRIO-PS-2G/1AC/24DC/20	2903151	1

Accessories	Type	Order No.	Pcs./Pkt.
Multi-channel, electronic device circuit breaker with active current limitation for protecting four loads at 24 V DC in the event of overload and short circuit. With nominal current assistant and electronic locking of the set nominal currents. For installation on DIN rails.	CBM E4 24DC/0.5-10A NO-R	2905743	1
Multi-channel, electronic device circuit breaker with active current limitation for protecting eight loads at 24 V DC in the event of overload and short circuit. With nominal current assistant and electronic locking of the set nominal currents. For installation on DIN rails.	CBM E8 24DC/0.5-10A NO-R	2905744	1
VARIOFACE module, with two equipotential busbars (P1, P2) for potential distribution, for mounting on NS 35 rails. Module width: 70.4 mm	VIP-2/SC/PDM-2/24	2315269	1
VARIOFACE module with push-in connection and two equipotential busbars (P1, P2) for potential distribution, for mounting on NS 35 rails. Module width: 57.1 mm	VIP-3/PT/PDM-2/24	2903798	1

Our range of accessories is being continually extended, our current range can be found in the download area.

4 Technical data

Input data	
Nominal input voltage range (for DC, connect a suitable fuse)	100 V AC ... 240 V AC -15 % ... +10 % 110 V DC ... 250 V DC
Input voltage range	85 V AC ... 264 V AC 99 V DC ... 275 V DC
Derating	< 100 V AC (2.5 %/V)
Electric strength, max.	≤ 300 V AC 15 s
Current consumption (for nominal values)	5.6 A (100 V AC) 2.4 A (240 V AC) 4.9 A (110 V DC) 2.1 A (250 V DC)
Frequency	50 Hz ... 60 Hz
Inrush current limitation (at 25°C)	≤ 20 A (typical)
Inrush surge current I^2t	< 0.9 A^2s
Input fuse internal (device protection)	10 A
Mains buffering	> 10 ms (120 V AC) > 15 ms (230 V AC)
A choice of suitable fuses	10 A ... 16 A (Characteristics B, C, D, K)

Input connection data	
Connection method	Push-in connection
Conductor cross section, solid	0.2 mm^2 ... 4 mm^2
Conductor cross section, flexible	0.2 mm^2 ... 2.5 mm^2
Cross section AWG	24 ... 12
Stripping length	10 mm

Output data

Nominal output voltage	24 V DC ±1 %
Setting range of the output voltage	24 V DC ... 28 V DC (> 24 V DC, constant capacity restricted)
Output current	20 A 30 A (5 s)
Control deviation	< 1 % (change in load, static 10 % ... 90 %) < 3 % (Dynamic load change 10 % ... 90 %, 10 Hz) < 0.1 % (change in input voltage ±10 %)
Efficiency	> 93 % (for 230 V AC and nominal values)
Rise time	≤ 30 ms (U_{OUT} (10 % ... 90 %))
Residual ripple	≤ 30 mV_{PP}
Connection in parallel	Yes, for redundancy and increased capacity
Connection in series	Yes
Protection against surge voltage on the output	≤ 30 V DC

Output connection data

Connection method	Push-in connection
Conductor cross section, solid	0.2 mm^2 ... 10 mm^2
Conductor cross section, flexible	0.2 mm^2 ... 6 mm^2
Conductor cross section AWG	24 ... 8
Stripping length	10 mm

Signaling DC OK

Types of signaling	LED, floating signal contact
Signal threshold	U_{OUT} < 0.9 x U_N
Type of signaling	LED
Status indicator	green
Type of signaling	Switch contact
Maximum switching voltage	30 V AC/DC
Continuous load current	100 mA

Signal connection data

Connection method	Push-in connection
Conductor cross section, solid	0.2 mm^2 ... 1.5 mm^2
Conductor cross section, flexible	0.2 mm^2 ... 1.5 mm^2
Conductor cross section AWG	24 ... 16
Stripping length	8 mm

General data

Insulation voltage input/output	4 kV AC (type test) 1.5 kV AC (routine test)
Degree of protection	IP20
Protection class	I (in closed control cabinet)
Inflammability class in acc. with UL 94 (housing)	V0
MTBF (IEC 61709, SN 29500)	> 1800000 h (25 °C) > 1000000 h (40°C) > 480000 h (60°C)
Type of housing	Aluminum (AlMg3)
Hood version	Polycarbonate
Dimensions W / H / D (state of delivery)	68 mm / 130 mm / 160 mm
Weight	1.5 kg

Power consumption	
Maximum power dissipation NO-Load	< 5.7 W
Power loss nominal load max.	< 44 W

Ambient conditions	
Ambient temperature (operation)	-25 °C ... 70 °C (> 60 °C Derating: 2,5 %/K)
Ambient temperature (start-up type tested)	-40 °C
Ambient temperature (storage/transport)	-40 °C ... 85 °C
Max. permissible relative humidity (operation)	≤ 95 % (at 25 °C, non-condensing)
Maximum altitude	≤ 4000 m (> 2000 m, observe derating)
Vibration (operation)	< 15 Hz, amplitude ±2.5 mm (according to IEC 60068-2-6) 15 Hz ... 150 Hz, 4g, 90 min.
Shock	30g in each direction, according to IEC 60068-2-27
Pollution degree	2
Climatic class	3K3 (in acc. with EN 60721)

Standards	
Electrical Equipment for Machinery	EN 60204-1
Electrical safety (of information technology equipment)	IEC 60950-1/VDE 0805 (SELV)
Electronic equipment for use in electrical power installations	EN 50178/VDE 0160 (PELV)
SELV	IEC 60950-1 (SELV) and EN 60204-1 (PELV)
Safe isolation	DIN VDE 0100-410
Limitation of mains harmonic currents	EN 61000-3-2
Network version/undervoltage	Semi F47-0706
Rail applications	EN 50121-4

Approvals	
UL	UL Listed UL 508 UL/C-UL Recognized UL 60950-1
	GL applied for

Current approvals/permissions for the product can be found in the download area under phoenixcontact.net/products.

Conformance with EMC Directive 2004/108/EC		
Noise immunity according to EN 61000-6-2		
	EN 61000-6-2 requirement	**Tested**
Electrostatic discharge EN 61000-4-2		
Housing contact discharge	4 kV (Test intensity 2)	6 kV (Test intensity 4)
Housing air discharge	8 kV (Test intensity 3)	8 kV (Test intensity 4)
Comments	Criterion B	Criterion A
Electromagnetic HF field EN 61000-4-3		
Frequency range	80 MHz ... 1 GHz	80 MHz ... 1 GHz
Test field strength	10 V/m (Test intensity 3)	10 V/m (Test intensity 3)
Frequency range	1.4 GHz ... 2 GHz	1 GHz ... 2 GHz
Test field strength	3 V/m (Test intensity 2)	10 V/m (Test intensity 3)
Frequency range	2 GHz ... 2.7 GHz	2 GHz ... 3 GHz
Test field strength	1 V/m (Test intensity 1)	10 V/m (Test intensity 3)
Comments	Criterion A	Criterion A
Fast transients (burst) EN 61000-4-4		
Input	2 kV (Test intensity 3 - asymmetrical)	4 kV (Test intensity 4 - asymmetrical)
Output	2 kV (Test intensity 3 - asymmetrical)	2 kV (Test intensity 3 - asymmetrical)
Signal	1 kV (Test intensity 1 - asymmetrical)	1 kV (Test intensity 2 - asymmetrical)
Comments	Criterion B	Criterion A
Surge current loads (surge) EN 61000-4-5		
Input	1 kV (Test intensity 1 - symmetrical) 2 kV (Test intensity 1 - asymmetrical)	3 kV (Test intensity 3 - symmetrical) 6 kV (Test intensity 4 - asymmetrical)
Output	0.5 kV (Test intensity 1 - symmetrical) 0.5 kV (Test intensity 1 - asymmetrical)	1 kV (Test intensity 2 - symmetrical) 2 kV (Test intensity 1 - asymmetrical)
Signal	1 kV (Test intensity 2 - asymmetrical)	1 kV (Test intensity 2 - asymmetrical)
Comments	Criterion B	Criterion B
Conducted interference EN 61000-4-6		
Input/output	asymmetrical	asymmetrical
Frequency range	0.15 MHz ... 80 MHz	0.15 MHz ... 80 MHz
Voltage	10 V (Test intensity 3)	10 V (Test intensity 3)
Comments	Criterion A	Criterion A

Key	
Criterion A	Normal operating behavior within the specified limits.
Criterion B	Temporary impairment to operational behavior that is corrected by the device itself.

Emitted interference in acc. with EN 61000-6-3	
Radio interference voltage in acc. with EN 55011	EN 55011 (EN 55022) Class B, area of application: Industry and residential
Emitted radio interference in acc. with EN 55011	EN 55011 (EN 55022) Class B, area of application: Industry and residential

All technical specifications are nominal and refer to a room temperature of 25 °C and 70% relative humidity at 2000 m above sea level.

5 Safety regulations and installation notes

Before startup please ensure:
- Installation and startup may only be carried out by qualified personnel.
- The relevant country-specific regulations must be observed.

NOTE: Danger if used improperly
- The device is a built-in device.
- The IP20 degree of protection (IEC 60529/EN 60529) of the device is intended for use in a clean and dry environment. Do not subject the device to any load that exceeds the described limits.
- Do not subject the device to mechanical and/or thermal loads that exceed the specified limits.
- It is not permissible to open or modify the device. Do not repair the device yourself but replace it with an equivalent device. Repairs may only be carried out by the manufacturer. The manufacturer is not liable for damage resulting from violation.

CAUTION:

Before startup please ensure:
- Connection must be performed by specialist personnel and protection against electric shock ensured.
- It must be possible to switch off the device outside the power supply according to the regulations in EN 60950-1 (e.g., by line protection on the primary side).
- All feed lines are sufficiently protected and dimensioned!
- All output lines are dimensioned according to the maximum output current of the device or separately protected!
- Sufficient convection is guaranteed!

EXPLOSION HAZARD!

Only remove equipment when it is disconnected and not in the potentially explosive area.

DANGER

Never carry out work on live parts!
The housing can become very hot, depending on the ambient temperature and load!

6 Basic circuit diagram

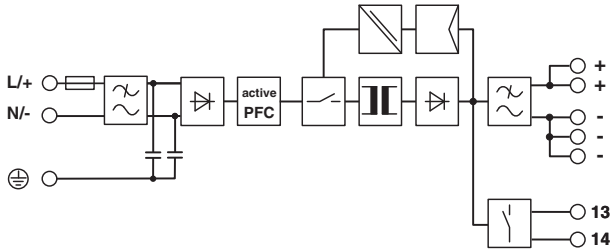


Figure 1 Block diagram

Key:	
	Rectification
active PFC	Power factor correction filter
	Switch
	Electrically isolated signal transmission
	Regulation
	Transformer
	Filter
	Floating switching output

7 Structure

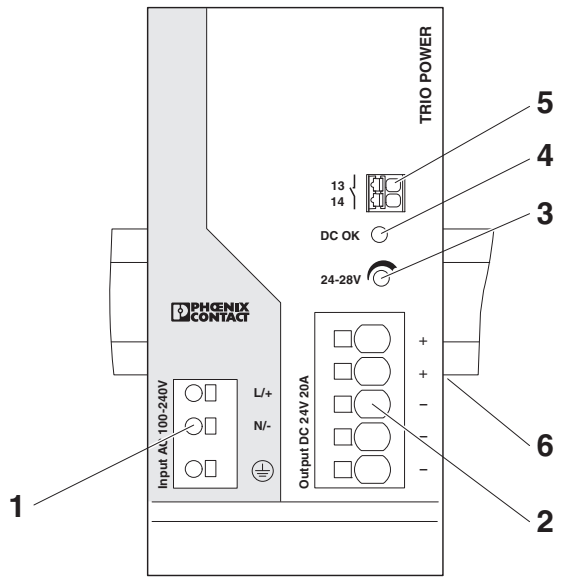


Figure 2 Function elements

No.	Description of the function elements
1.	Connection terminal block input voltage: Input L/N/PE
2.	Connection terminal block output voltage: Output DC +/-
3.	Potentiometer, output voltage: 24 V DC ... 28 V DC
4.	Signaling DC OK LED
5.	Floating signal contact: max. 30 V AC/DC, 100 mA
6.	Integrated universal snap-on foot

8 Cooling

Heat is dissipated from the power supply via the heatsinks integrated into the housing surfaces. Convection to dissipate heat from the power supply only takes place in small dimensions above the housing openings.

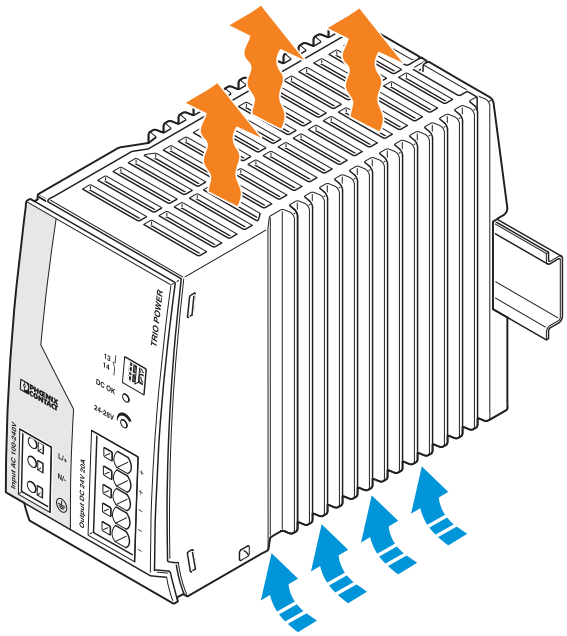


Figure 3 Convection

The power supply can be aligned without minimum lateral clearance up to an ambient temperature of 40°C. In a temperature range up to ≤ 70°C, a lateral minimum clearance of 10 mm between two active components (e.g., power supply) is required.

The device can be snapped onto all DIN rails in accordance with EN 60715 and should be mounted in the normal mounting position.

To ensure sufficient wiring space to wire the power supply, we recommend a vertical minimum clearance from other devices of 50 mm. Depending on the cable duct used, a smaller clearance may be possible.

9 Mounting position and dimensions

9.1 Mounting position

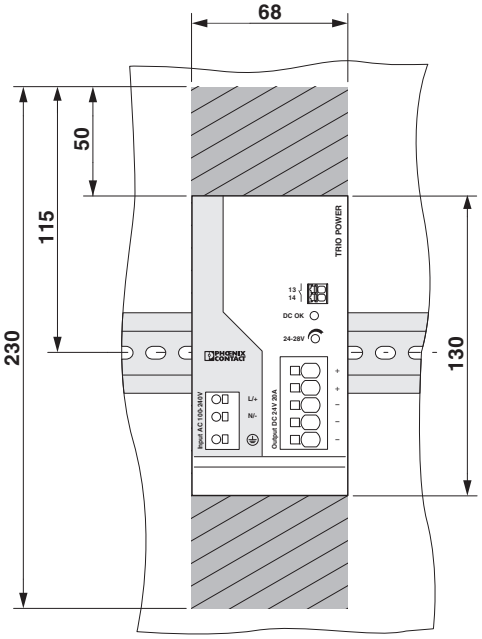


Figure 4 Locked areas

Possible mounting positions:

Normal mounting position, installation depth 160 mm (+ DIN rail)

9.2 Device dimensions

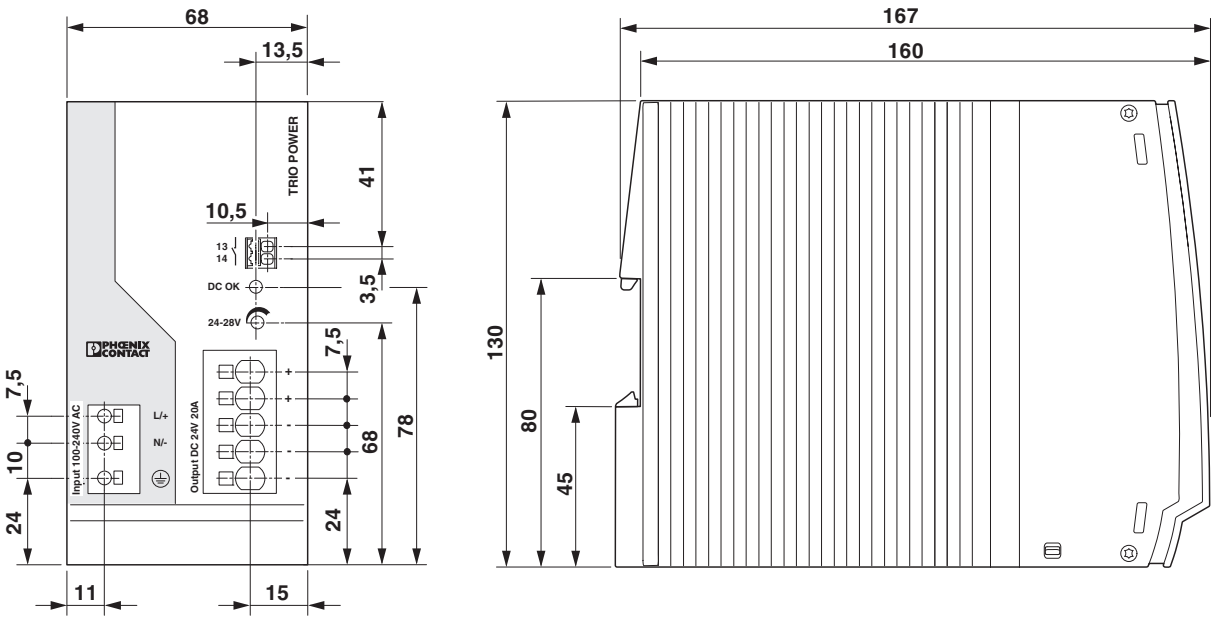


Figure 5 Device dimensions

10 Mounting/removal

10.1 Assembly

Position the module with the DIN rail guide on the upper edge of the DIN rail, and snap it in with a downward motion.

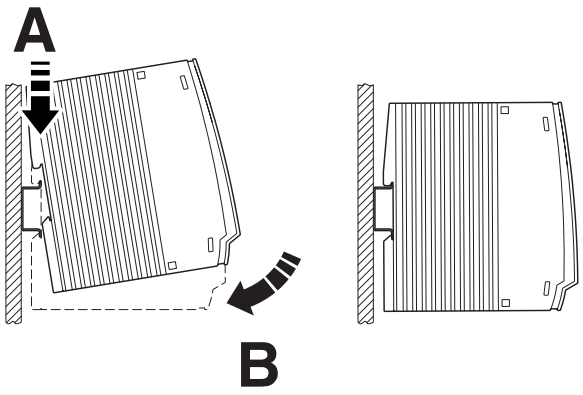


Figure 6 Assembly on standard DIN rail

10.2 Removal

Pull the snap lever open with the aid of a screwdriver and slide the module out at the lower edge of the DIN rail.

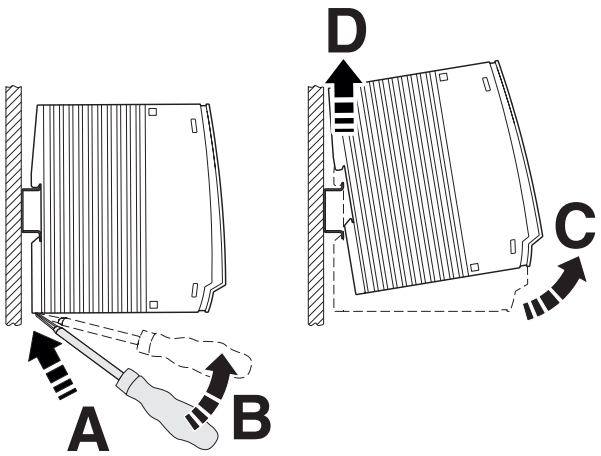


Figure 7 Removing the DIN rail

11 Device connection terminal blocks

11.1 Push-in connection technology

All connection terminal blocks on the power supply have push-in connection technology on the front. The power supply is wired by simply plugging in the connecting cables, no tools are required. For the necessary connection parameters for the terminal blocks, please refer to the technical data.

11.1.1 Plug in connecting cable

The wiring is carried out by simply plugging the connecting cable into the contact opening provided. Insert the connecting cable as far as it will go.

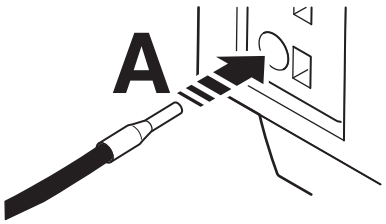


Figure 8 Insert connecting cable (push-in connection technology)

11.1.2 Loosen the connecting cable

To disconnect the wiring, take a suitable screwdriver and insert it into the opening for release. Then carefully pull the connecting cable out of the contact opening.

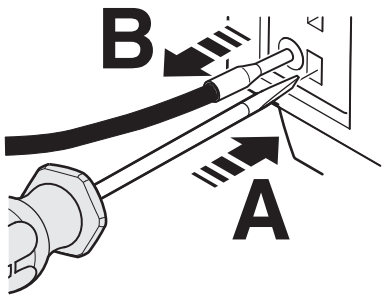


Figure 9 Release connecting cable (push-in connection technology)

12 Input

For operation on two of the phase conductors of a three-phase system, an isolating facility for all poles must be provided.

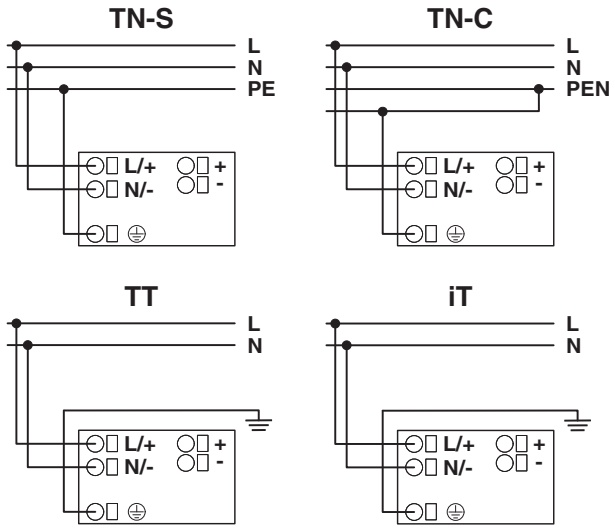


Figure 10 Network types

12.1 Position of input terminals

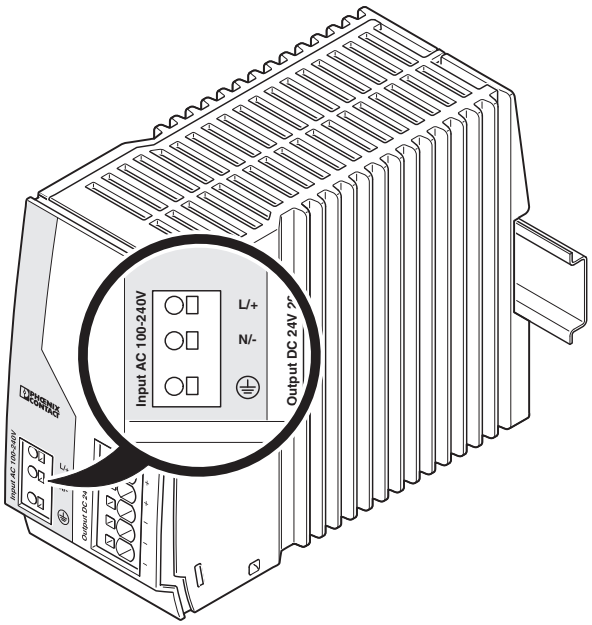


Figure 11 Position of input terminals

12.2 Protection of the primary side

Installation of the device must correspond to EN 60950 regulations. It must be possible to disconnect the device from the voltage using a suitable separator outside the power supply. For example, the primary-side line protection is suitable for this (see technical data).

An internal, approved AC/DC fuse is available as device protection. Additional device protection is not required.

If an internal fuse trips, this is due to a device fault. In this case, the device must be inspected in the factory. Opening the device or repairing it yourself is prohibited.

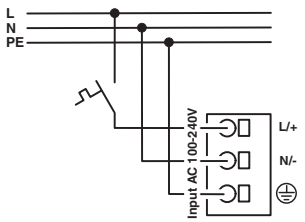


Figure 12 Schematic diagram, switching the input terminals

13 Output

A DC voltage for supplying the load is provided at the output of the power supply. The load is connected via the OUTPUT +/- connection terminal blocks.

By default, the power supply is pre-set to a nominal output voltage of 24 V DC.

The output voltage can also be set to the range from 24 V DC to 28 V DC using the potentiometer in order to compensate for a possible voltage drop due to the long cable lengths between the power supply and the load to be supplied.

13.1 Position of output terminals

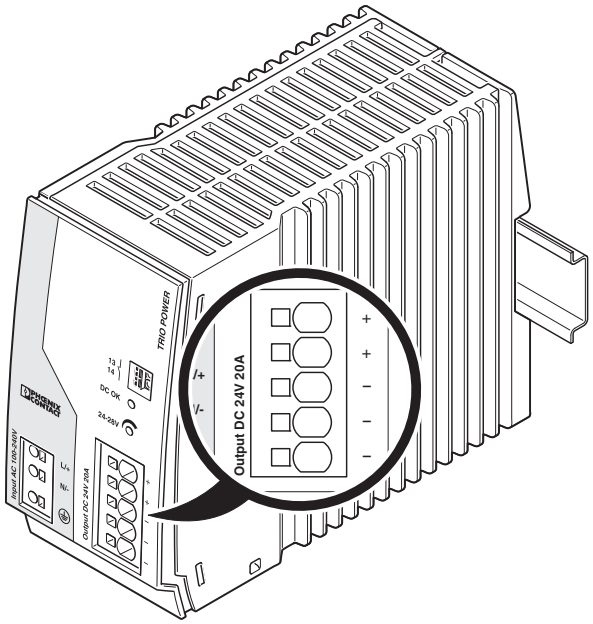


Figure 13 Position of output terminals

13.2 Protection of the secondary side

The power supply is electronically short-circuit-proof and idling-proof. In the event of an error, the output voltage is limited. It must be ensured that all output cables are dimensioned accordingly for the maximum output current or have separate protection.

The connecting cables on the secondary side should have large cross sections to keep the voltage drops in the cables as low as possible.

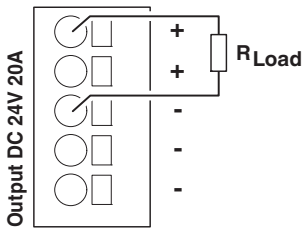


Figure 14 Schematic diagram, switching the output terminals

13.3 Output characteristic curve

The power supply works with a dynamic power reserve, the dynamic boost, as shown in the U/I characteristic curve in the figure. In the event of a secondary-side short circuit or overload, the output current is limited to 1.5 x I_N. The module does not switch off, but supplies a continuous output current instead. The secondary voltage is then reduced until the short circuit is eliminated. The U/I characteristic curve with the dynamic power reserve enables high switch-on currents of capacitive loads or inductive loads to be supplied reliably.

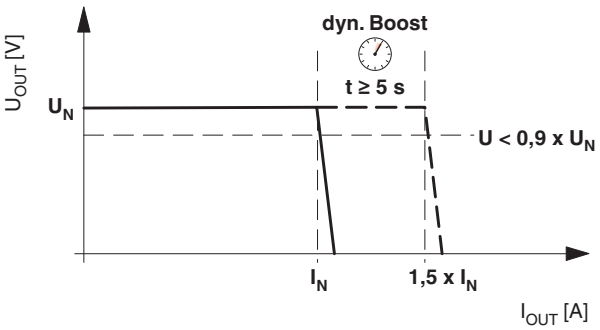


Figure 15 U/I characteristic curve with dynamic load reserve

- U_N = 24 V
- I_N = 20 A
- $I_{dyn.\ BOOST}$ = 30 A
- P_N = 480 W
- $P_{dyn.\ BOOST}$ = 720 W

14 Dynamic boost

The following example is used to explain how the power supply dynamic boost functions.

Example:

The power supply supplies a connected base load of 80% until time point t_1 (see illustration, schematic diagram of the dynamic boost behavior). If an additional load is activated while the power supply is in operation, the dynamic boost is requested for the period of time t_1 to t_2. The power supply provides the maximum dynamic power reserve of an additional 70% ($\Delta P_{dyn.\ Boost} = 1.5 \times I_N \times U_N - P_{Initial\ load}$).

As such, the requested overall total power corresponds to 150% of the nominal power. This power can be accessed directly for at least 5 s in the event that the output voltage remains the same. On reaching time point t_2, the dynamic boost is once more returned to the output value of the base load for thermal offloading of the power supply. In this case, the base load amounts to the same value of 80%, as prior to time point t_1. If the request to supply the load still exists, when the time intervals t_2 to t_3 have expired (at least 7 s), a new cyclical switching of the dynamic power reserve occurs, to a total of 70%.

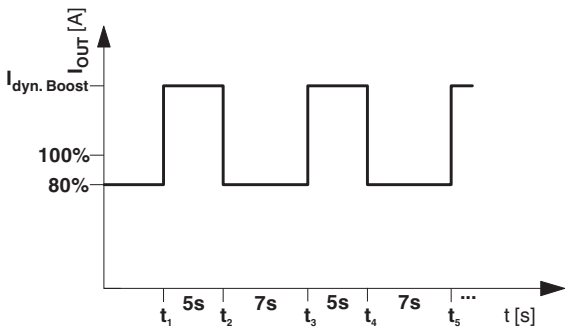


Figure 16 Schematic diagram of dynamic boost behavior

Depending on the connected base load, the power supply firmware determines the time intervals for the dynamic boost procedure or the time required for the release of thermal tension. The ratio of dynamic boost time and time for thermal tension release always varies, depending on load.

15 Signaling

15.1 DC OK-LED

The DC OK-LED is available for function monitoring. The LED is continuously illuminated when the output voltage is > 90 % of the nominal output voltage U_{OUT} (24 V DC).

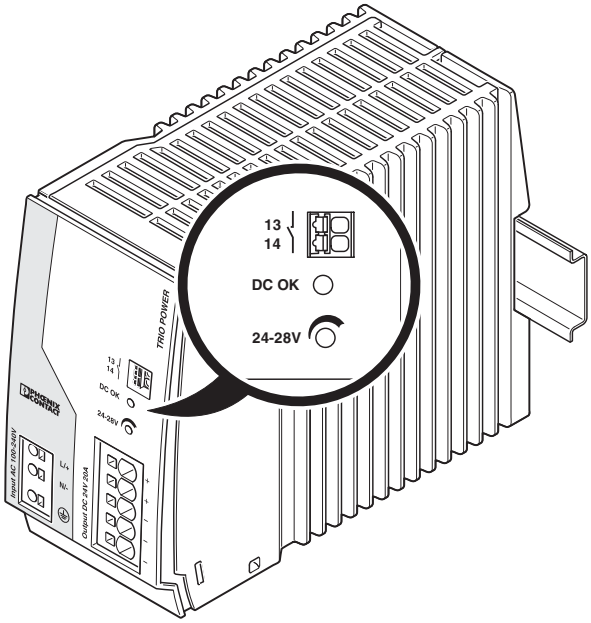


Figure 17 Location of the elements

15.2 Floating signal contact

A floating diagnostics contact can be used to forward data to a higher-level control system. When opened, the diagnostics contact indicates an underrange of more than 90% for the nominal output voltage U_{OUT}.

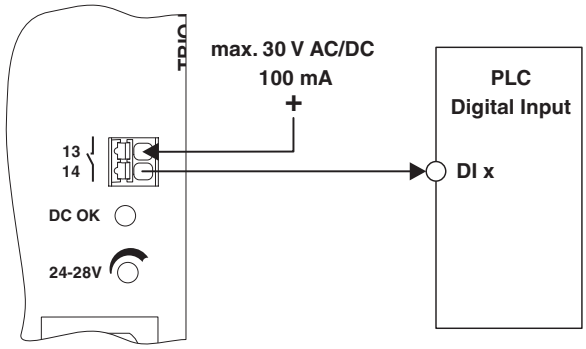


Figure 18 Wiring principle

16 Derating

16.1 Temperature-dependent derating

The device provides both the I_N nominal output current and the $I_{dyn.\ BOOST}$ dynamic output current at ambient temperatures up to +60 °C. For ambient temperatures above +60°C, the ambient power must be decreased by 2.5% per Kelvin increase in temperature. For ambient temperatures above +70°C or in the event of a thermal overload, the device does not switch off. The output power will be decreased by enough to allow device protection. Once the device has cooled down, the output power will be increased again.

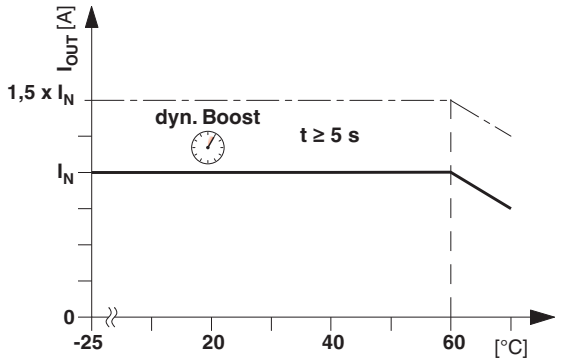


Figure 19 Temperature derating in normal mounting position

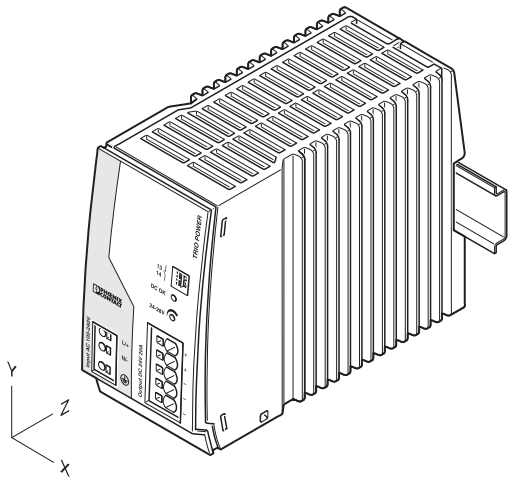
16.2 Position-dependent derating

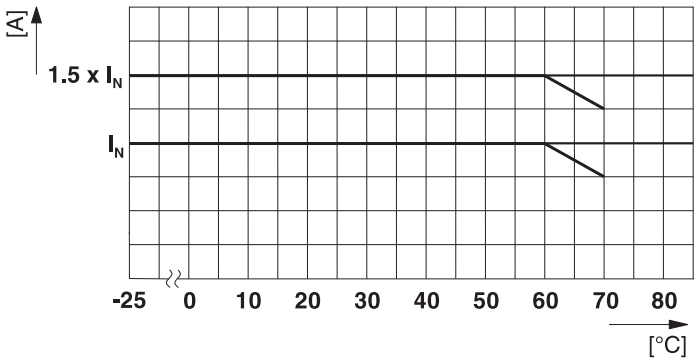
The power supply can be installed onto all 35 mm DIN rails according to EN 60175. The normal mounting position of the power supply is horizontal.

When installing in a different mounting position, derating should be adhered to.

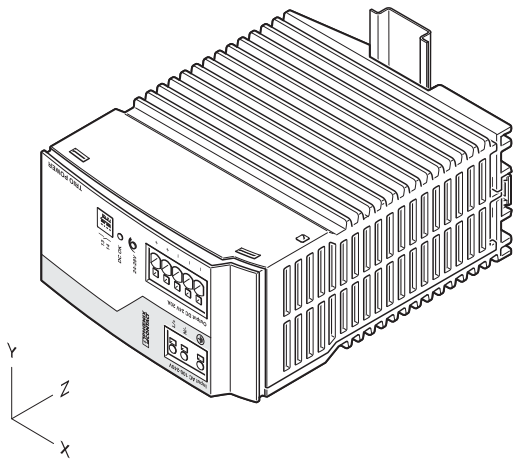
The characteristic curve can be used to determine the maximal output power to be drawn for each ambient temperature for different mounting positions.

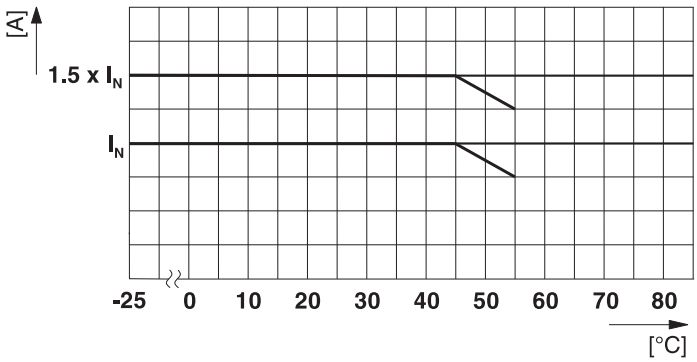
Normal mounting position



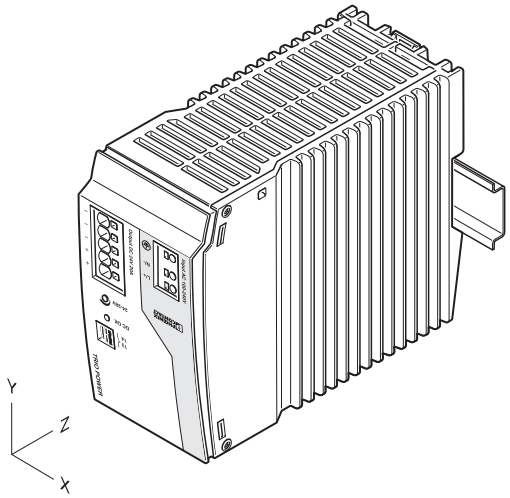


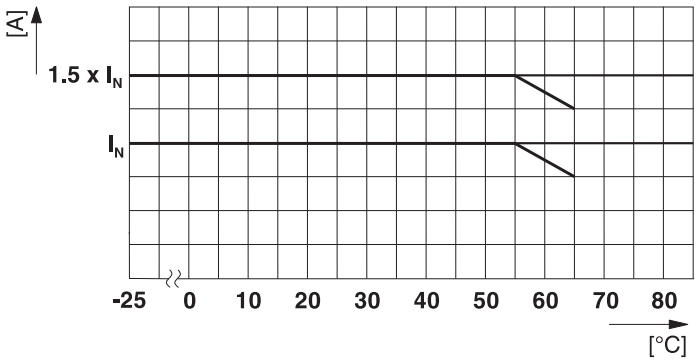
Rotated mounting position 90° X-axis



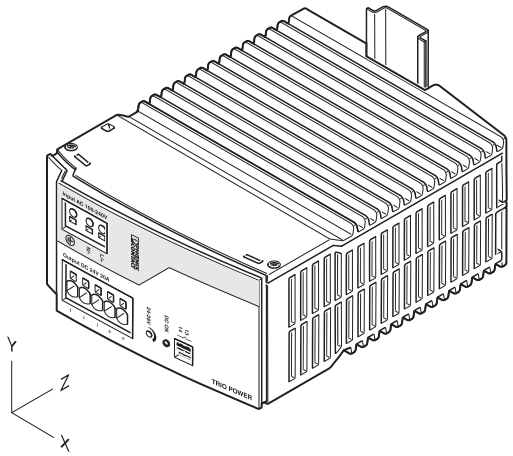


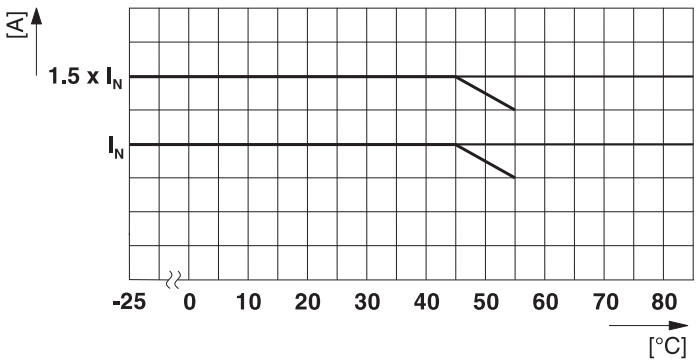
Rotated mounting position 180° X-axis



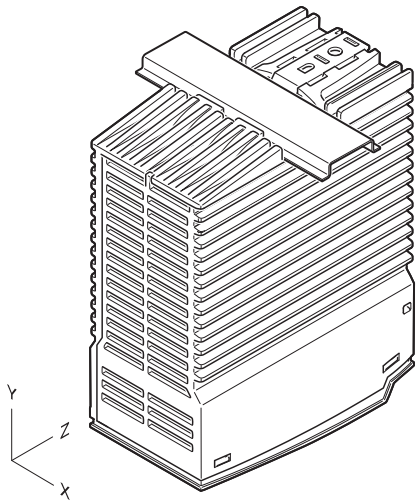


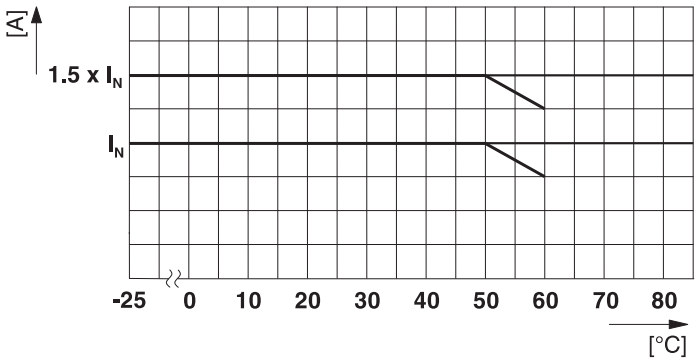
Rotated mounting position 270° X-axis



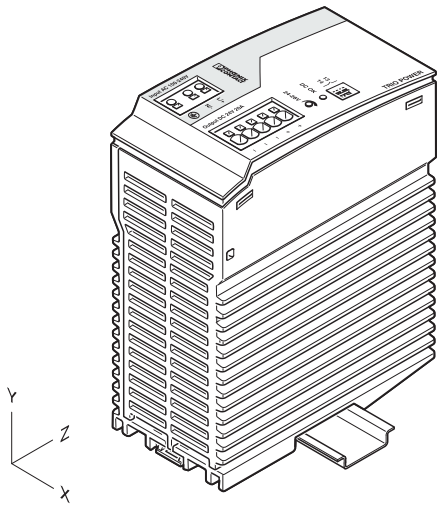


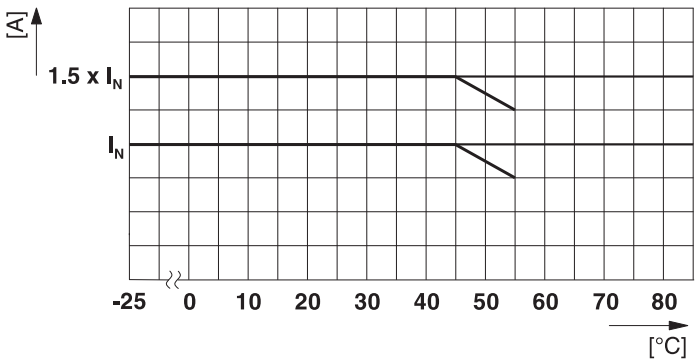
Rotated mounting position 90° Z-axis





Rotated mounting position 270° Z-axis





17 Operating modes

17.1 Series operation

Two power supplies can be switched in series, to double the output voltage. For connection in series, only power supplies of the same performance class should be used. An output voltage of, for example, 48 V DC can be provided, if two 24 V power supplies are connected in series.

Various voltage levels are made possible by varying the switching of the respective output voltage and the measurement reference point.

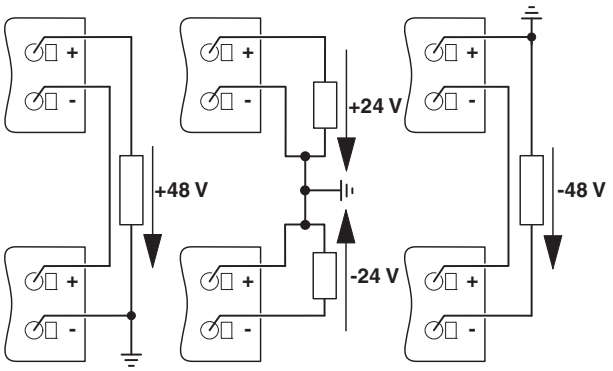


Figure 20 Wiring principle, voltage levels with two power supplies

17.2 Parallel operation

Devices of the same type can be connected in parallel to increase both redundancy and power. By default upon delivery, no further adjustments are required.
If the output voltage is adjusted, a uniform distribution of power is guaranteed by setting all parallel operated power supply units to exactly the same output voltage.
To ensure symmetrical current distribution we recommend that all cable connections from the power supply unit to the busbar are the same length and have the same cross section.
Depending on the system, for parallel connection of more than two power supplies a protective circuit should be installed at each individual device output (e.g., decoupling diode, DC fuse or circuit breaker). This prevents high return currents in the event of a secondary device fault.

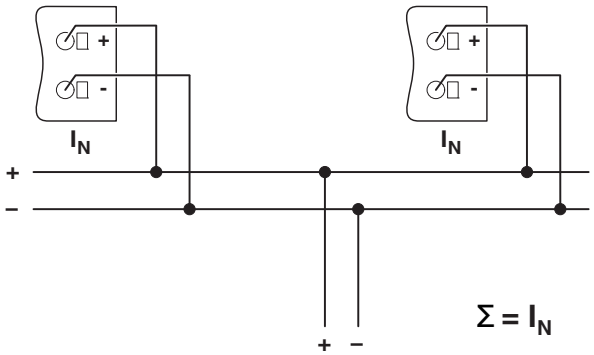


Figure 21 Schematic diagram in parallel operation

17.3 Redundant operation

Redundant circuits are suitable for supplying systems which place particularly high demands on operational reliability. If a fault occurs in the primary circuit of the first power supply unit, the second device automatically takes over the complete power supply without interruption, and vice versa. For this purpose, the power supply units to be connected in parallel must be large enough to ensure that the total current requirements of all loads can be fully met by one power supply unit. External decoupling diodes or ORING modules are required for 100% redundancy.

17.3.1 Decoupling with diode module

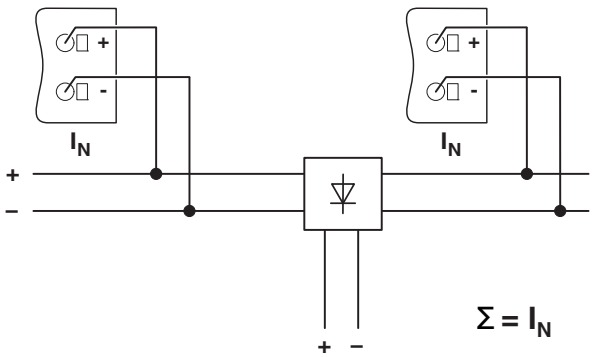


Figure 22 Schematic diagram, decoupling with diode module

17.3.2 Decoupling with ORING module

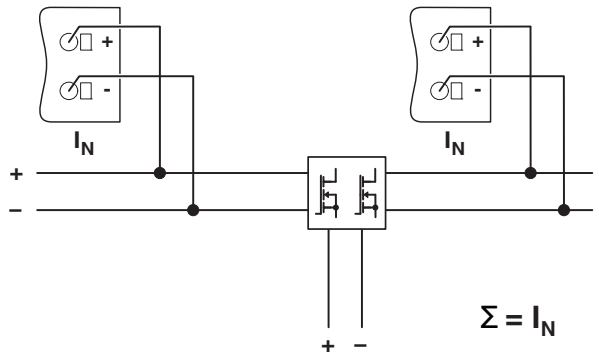


Figure 23 Schematic diagram, decoupling with ORING module

17.4 Increasing power

The output current can be increased to n x I_N in the case of n parallel connected devices. Parallel connection for increasing power is used when extending existing systems. A parallel connection is recommended if the power supply unit does not cover the current consumption of the most powerful load. Otherwise, the load should be distributed between individual devices that are independent from one another.

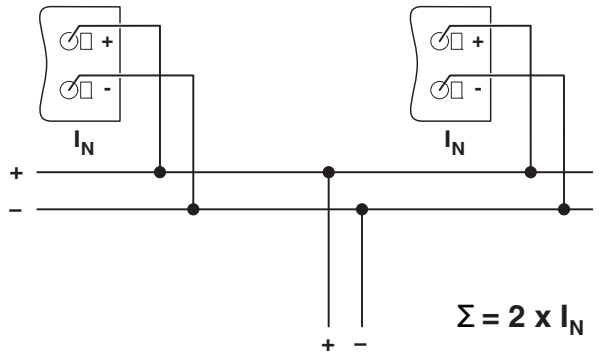


Figure 24 Schematic diagram of increased performance

SECTION 6.5

ETHERNET SWITCH

Lone Star Blower
8883 West Monroe
Houston, TX 77061

PH: 832-532-3112
FAX: 832-532-3115

Industrial Ethernet Switch - FL SWITCH 3006T-2FX - 2891036

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Managed Ethernet switch with six RJ45 ports at 10/100 Mbps, two SC format fiber optic ports and an operating temperature of -40°C ... +75°C

Product Description

FL SWITCH 3000 managed industrial Ethernet switches combine extensive network performance and securtiy features with complete IEEE redundancy (STP/RSTP/MST) and 15 ms recovery time extended ring redundancy. Unique web customization provides a simplified user interface for today's applications and scalable functionality for future needs. A comprehensive mix of fiber optic and copper port connections meets a wide range of applications.

Your advantages

- Unique cleanup function hides unused configuration pages, reducing complexity, maintenance and startup times
- Auto negotiation and autocrossing detection simplifies installation and setup
- Security options with cable locking
- Secure web-based and SNMP-based management
- Extensive web diagnostics with configurable LED and remote alarm contacts
- RJ45 ports support a transmission speed of 10/100 Mbps; fiber optic ports support 100 Mbps
- -40 to 75°C and -10 to 60°C ambient temperature versions

RoHS

Key Commercial Data

Packing unit	1 pc
GTIN	4 046356 659161
GTIN	4046356659161
Weight per Piece (excluding packing)	1,250.000 g
Custom tariff number	85176200
Country of origin	Taiwan

Industrial Ethernet Switch - FL SWITCH 3006T-2FX - 2891036

Technical data

Note

Utilization restriction	EMC: class A product, see manufacturer's declaration in the download area
	Use in potentially explosive areas is not permitted in China.

Dimensions

Width	54.4 mm
Height	146.4 mm
Depth	125 mm

Ambient conditions

Degree of protection	IP20
Ambient temperature (operation)	-40 °C ... 75 °C
Ambient temperature (storage/transport)	-40 °C ... 85 °C
Permissible humidity (operation)	5 % ... 95 % (non-condensing)
Permissible humidity (storage/transport)	5 % ... 95 % (non-condensing)
Air pressure (operation)	57 kPa ... 108 kPa (up to 4850 m above mean sea level)
Air pressure (storage/transport)	57 kPa ... 108 kPa (up to 4850 m above mean sea level)

Interfaces

Interface	Ethernet (RJ45)
No. of ports	6 (RJ45 ports)
Note on the connection method	Auto negotiation and autocrossing
Transmission physics	Ethernet in RJ45 twisted pair
Transmission speed	10/100 Mbps
Transmission length	100 m
Interface	Fiber optic interface
No. of ports	2 (SC multi-mode)
Transmission physics	multi-mode fiberglass
Transmission speed	100 Mbps (full duplex)
Transmission length	12.1 km (fiberglass with F-G 62.5/125 0.7 dB/km F1000)
	3.3 km (fiberglass with F-G 62.5/125 2.6 dB/km F600)
	7.1 km (fiberglass with F-G 50/125 0.7 dB/km F1200)
	3.1 km (fiberglass with F-G 50/125 1.6 dB/km F800)
Wavelength	1300 nm

Function

Basic functions	Store and forward switch, Extended Ring and IEEE redundancy, Multicast control, IGMP snooping, trunking, Port and Tagging VLANs, Port and IEEE 802.1x security, SNMP V3 and Https security, SNTP, web customization, user accounts

Industrial Ethernet Switch - FL SWITCH 3006T-2FX - 2891036

Technical data

Function

Redundancy	ERR (Extended ring redundancy)
Status and diagnostic indicators	LEDs: U_{S1}, U_{S2} (redundant voltage supply), link and activity per port
Signal contact control voltage	250 V AC
Signal contact control current	1 A

Network expansion parameters

Cascading depth	Network, linear, and star structure: any
Maximum conductor length (twisted pair)	100 m

Supply voltage

Supply voltage	24 V DC (redundant)
Residual ripple	3.6 V_{PP} (within the permitted voltage range)
Supply voltage range	12 V DC ... 48 V DC
Typical current consumption	330 mA (at U_S = 24 V DC)
Inrush current	8.2 A (2 ms)

General

Mounting type	DIN rail
Type AX	Block design
Net weight	960 g
Housing material	Aluminum
MTTF	26 Years (MIL-HDBK-217F standard, temperature 25°C, operating cycle 100%)

Connection data

Connection method	Pluggable COMBICON screw connections
Conductor cross section solid min.	0.2 mm²
Conductor cross section solid max.	2.5 mm²
Conductor cross section flexible min.	0.2 mm²
Conductor cross section flexible max.	2.5 mm²
Conductor cross section AWG min.	24
Conductor cross section AWG max.	12
Stripping length	7 mm

Standards and Regulations

Type of test	Shock in acc. with EN 60068-2-27/IEC 60068-2-27
Test result	25g, 11 ms half-sine shock pulse
Type of test	Vibration resistance in acc. with EN 60068-2-6/IEC 60068-2-6
Test result	5g, 150 Hz, Criterion 3
Type of test	Free fall in acc. with IEC 60068-2-32

Industrial Ethernet Switch - FL SWITCH 3006T-2FX - 2891036

Technical data

Standards and Regulations

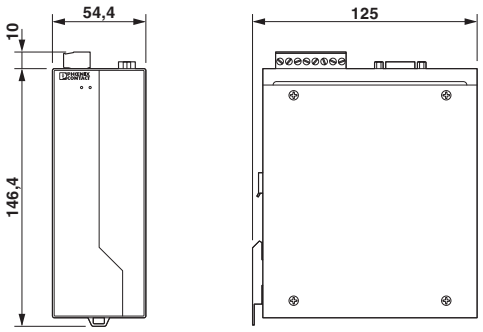
Test result	1 m
Noise emission	EN 61000-6-4
Noise immunity	EN 61000-6-2:2005
Conformance	CE-compliant
ATEX	# II 3 G Ex nA nC IIC T4 Gc
IECEx	Ex nA nC IIC T4 Gc
UL, USA/Canada	Class I, Div. 2, Groups A, B, C, D

Environmental Product Compliance

REACh SVHC	Lead 7439-92-1
China RoHS	Environmentally Friendly Use Period = 10;
	For details about hazardous substances go to tab “Downloads”, Category “Manufacturer's declaration”

Drawings

Dimensional drawing



Classifications

eCl@ss

eCl@ss 10.0.1	19170401
eCl@ss 11.0	19170401
eCl@ss 4.0	27250500
eCl@ss 4.1	27250500
eCl@ss 5.0	19030100
eCl@ss 5.1	19030100
eCl@ss 6.0	19170100
eCl@ss 7.0	19170106
eCl@ss 9.0	19170106

Industrial Ethernet Switch - FL SWITCH 3006T-2FX - 2891036

Classifications

ETIM

ETIM 4.0	EC000734
ETIM 5.0	EC000734
ETIM 6.0	EC000734
ETIM 7.0	EC000734

UNSPSC

UNSPSC 6.01	43172901
UNSPSC 7.0901	43201404
UNSPSC 11	43172015
UNSPSC 12.01	43201410
UNSPSC 13.2	43222612
UNSPSC 18.0	43222612
UNSPSC 19.0	43222612
UNSPSC 20.0	43222612
UNSPSC 21.0	43222612

Approvals

Approvals

Approvals

UL Listed / cUL Listed / EAC / EAC / KC / UL Listed / cUL Listed

Ex Approvals

UL Listed / cUL Listed / UL Listed / cUL Listed

Approval details

UL Listed		http://database.ul.com/cgi-bin/XYV/template/LISEXT/1FRAME/index.htm	FILE E 140324

cUL Listed		http://database.ul.com/cgi-bin/XYV/template/LISEXT/1FRAME/index.htm	FILE E 140324

Industrial Ethernet Switch - FL SWITCH 3006T-2FX - 2891036

Approvals

EAC			RU *- DE.A*08.B.00739
EAC			RU *- DE.A*30.B.01735
KC		http://eng.kcc.go.kr/user/ehpMain.do	KCC-REI- PCK-FL289103
UL Listed		http://database.ul.com/cgi-bin/XYV/template/LISEXT/1FRAME/index.htm	FILE E 238705
cUL Listed		http://database.ul.com/cgi-bin/XYV/template/LISEXT/1FRAME/index.htm	FILE E 238705

SECTION 6.6

SURGE PROTECTION DEVICE

Lone Star Blower
8883 West Monroe
Houston, TX 77061

PH: 832-532-3112
FAX: 832-532-3115

Type 3 surge protection device - PLT-SEC-T3-120-FM-UT - 2907918

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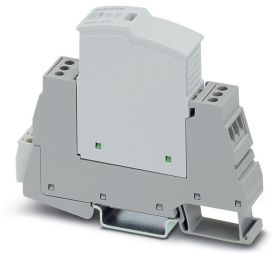


Type 2/3 surge protection, consisting of protective plug and base element, with integrated status indicator and remote signaling for single-phase power supply networks. Nominal voltage 120 V AC/DC.

Your advantages

- Easy to maintain due to consistently pluggable protection modules
- Excellent level of information provided by mechanical/visual status indicator and remote indication contact
- Your preferred connection technology can be selected as both screw connection and Push-in connection are available
- Optimal additional protection of the industrial power supply for a longer service life and increased availability of the system
- 5-year warranty on your QUINT 4 power supply when installed together with PLT-SEC, see document in the download area

Key Commercial Data

Packing unit	1 pc
GTIN	4 055626 257440
GTIN	4055626257440
Weight per Piece (excluding packing)	96.000 g
Custom tariff number	85363030
Country of origin	Germany

Technical data

Dimensions

Height	93.4 mm
Width	17.7 mm
Depth	74.5 mm (incl. DIN rail 7.5 mm)
Horizontal pitch	1 Div.

Type 3 surge protection device - PLT-SEC-T3-120-FM-UT - 2907918

Technical data

Ambient conditions

Degree of protection	IP20
Ambient temperature (operation)	-40 °C ... 80 °C
Ambient temperature (storage/transport)	-40 °C ... 80 °C
Altitude	≤ 2000 m (operating voltage remote contact ≤ 250 V)
	≤ 6000 m (operating voltage remote contact ≤ 150 V)
Permissible humidity (operation)	5 % ... 95 %
Shock (operation)	30g (Half-sine / 11 ms / 3x ±X, ±Y, ±Z)
Vibration (operation)	5g (5 ... 500 Hz / 2.5 h / X, Y, Z)

General

EN type	T2 / T3
IEC power supply system	TT
	TN-S
Number of ports	One
Mode of protection	L-N
	L-PE
	N-PE
Mounting type	DIN rail: 35 mm
Color	light grey RAL 7035
	traffic grey A RAL 7042
Housing material	PA 6.6-FR 20 % GF
	PA 6.6-FR
Degree of pollution	2
Flammability rating according to UL 94	V-0
Type	DIN rail module, two-section, divisible
Number of positions	2
Surge protection fault message	Optical, remote indicator contact

Protective circuit

Nominal voltage U_N	120 V AC (TN-S)
	120 V AC (TT)
Nominal frequency f_N	50 Hz (60 Hz)
Maximum continuous voltage U_C	150 V AC
Rated load current I_L	26 A (at 30 °C)
Residual current I_{PE}	≤ 5 µA
Nominal discharge current I_n (8/20) µs	5 kA
Standby power consumption P_C	≤ 10.6 mVA (at U_{REF})
	≤ 13.5 mVA (at U_C)

Type 3 surge protection device - PLT-SEC-T3-120-FM-UT - 2907918

Technical data

Protective circuit

Reference test voltage U_{REF}	132 V AC
Max. discharge current I_{max} (8/20) µs	10 kA
Combination wave U_{OC}	6 kV
Voltage protection level U_p (L-N)	≤ 0.75 kV (at U_{OC})
	≤ 0.95 kV (at I_n)
Voltage protection level U_p (L-PE)	≤ 0.85 kV
Voltage protection level U_p (N-PE)	≤ 0.85 kV
TOV behavior at U_T (L-N)	240 V AC (5 s / withstand mode)
	240 V AC (120 min / withstand mode)
TOV behavior at U_T (L-PE)	240 V AC (5 s / withstand mode)
	240 V AC (120 min / withstand mode)
	1332 V AC (200 ms / safe failure mode)
TOV behavior at U_T (N-PE)	1200 V AC (200 ms / safe failure mode)
Response time t_A (L-N)	≤ 25 ns
Response time t_A (L-PE)	≤ 100 ns
Response time t_A (N-PE)	≤ 100 ns
Short-circuit current rating I_{SCCR}	10 kA AC
Max. backup fuse with branch wiring	32 A (gG / B / C)
Maximum backup fuse for through wiring	25 A (gG / B / C)

Additional technical data

Short-circuit current rating I_{SCCR}	0.25 kA DC (Without additional backup fuse in the DC branch wiring)
	5 kA DC (for 20 A gG / B backup fuse)
Maximum continuous voltage U_C	150 V DC
Residual voltage U_{res} (L-N)	≤ 0.68 kV (at 2 kA)
	≤ 0.75 kV (at 3 kA)
	≤ 0.64 kV (at U_{OC} = 4 kV)
Residual voltage U_{res} (L-PE)	≤ 0.58 kV (at 2 kA)
	≤ 0.65 kV (at 3 kA)
	≤ 0.75 kV (at U_{OC} = 4 kV)
Residual voltage U_{res} (N-PE)	≤ 0.58 kV (at 2 kA)
	≤ 0.65 kV (at 3 kA)
	≤ 0.75 kV (at U_{OC} = 4 kV)
Mode of protection	(DC+) - (DC-)
	(DC+/DC-) - PE
IEC test classification (in accordance with IEC 61643-21)	D1
Impulse durability (line-line)	D1 - 500 A

Type 3 surge protection device - PLT-SEC-T3-120-FM-UT - 2907918

Technical data

Additional technical data

Impulse durability (line-earth)	D1 - 500 A
Pulse discharge current I_{imp} (10/350) µs (line-line)	0.5 kA
Pulse discharge current I_{imp} (10/350) µs (line-earth)	0.5 kA

Indicator/remote signaling

Switching function	Changeover contact
Operating voltage	250 V AC
	125 V DC (200 mA DC)
Operating current	0.5 A AC
	0.5 A DC (75 V DC)
Connection method	Screw connection
Conductor cross section flexible	0.2 mm² ... 2.5 mm²
Conductor cross section solid	0.2 mm² ... 2.5 mm²
Conductor cross section AWG	30 ... 12
Screw thread	M3
Tightening torque	0.5 Nm
Stripping length	10 mm

Connection data

Connection method	Screw connection
Conductor cross section flexible	0.2 mm² ... 2.5 mm²
Conductor cross section solid	0.2 mm² ... 4 mm²
Conductor cross section AWG	24 ... 12
Screw thread	M3
Tightening torque	0.5 Nm
Stripping length	10 mm

UL specifications

SPD Type	2 (Open-Type SPD)
Maximum continuous operating voltage MCOV	150 V AC
	150 V DC
Nominal voltage	150 V DC
Rated load current I_L	20 A
Mode of protection	L-N
	L-G
	N-G
	(DC+) - (DC-)
	(DC+) - G
	(DC-) - G

Type 3 surge protection device - PLT-SEC-T3-120-FM-UT - 2907918

Technical data

UL specifications

Power distribution system	Single phase
	DC
Nominal frequency	50/60 Hz
Voltage protection rating VPR (L-N)	700 V
Voltage protection rating VPR (L-G)	700 V
Voltage protection rating VPR (N-G)	900 V
Nominal discharge current I_n	5 kA
Short-circuit current rating (SCCR)	10 kA AC
	5 kA DC

UL indicator/remote signaling

Operating voltage	250 V AC (0.5 A)
	12 V DC (4 A)
	24 V DC (2 A)
	48 V DC (1 A)
Tightening torque	5 lb_f-in. ... 7 lb_f-in.
Conductor cross section AWG	30 ... 12

UL connection data

Conductor cross section AWG	16 ... 12
Tightening torque	4.4 lb_f-in.

Standards and Regulations

Standards/specifications	IEC 61643-11 2011
	EN 61643-11 2012

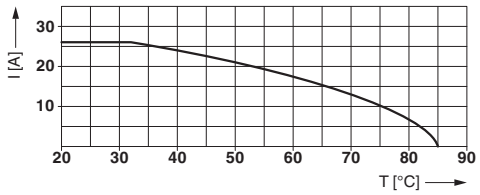
Environmental Product Compliance

China RoHS	Environmentally Friendly Use Period = 50 years
	For details about hazardous substances go to tab “Downloads”, Category “Manufacturer's declaration”

Drawings

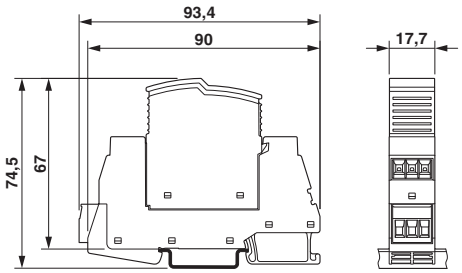
Type 3 surge protection device - PLT-SEC-T3-120-FM-UT - 2907918

Diagram

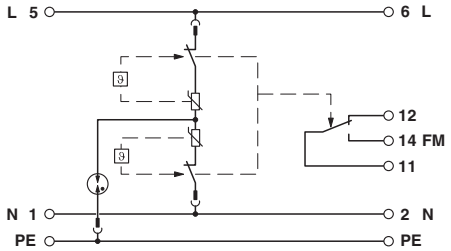


Nominal current depending on ambient temperature

Dimensional drawing



Circuit diagram



Classifications

eCl@ss

eCl@ss 10.0.1	27130806
eCl@ss 11.0	27130806
eCl@ss 6.0	27130800
eCl@ss 7.0	27130806
eCl@ss 9.0	27130806

ETIM

ETIM 5.0	EC000942
ETIM 6.0	EC000942
ETIM 7.0	EC000942

Approvals

Approvals

Approvals

DNV GL / CCA / UL Listed / KEMA-KEUR / IECEE CB Scheme / cUL Listed / EAC / CSA / cULus Listed

Type 3 surge protection device - PLT-SEC-T3-120-FM-UT - 2907918

Approvals

Ex Approvals

UL Recognized / cUL Recognized / cULus Recognized

Approval details

DNV GL	https://approvalfinder.dnvgl.com/	TAE00002U7
CCA		NTR-NL 7676
UL Listed	http://database.ul.com/cgi-bin/XYV/template/LISEXT/1FRAME/index.htm	FILE E 330181
KEMA-KEUR	http://www.dekra-certification.com	71-103027
IECEE CB Scheme	http://www.iecee.org/	NL-51083
cUL Listed	http://database.ul.com/cgi-bin/XYV/template/LISEXT/1FRAME/index.htm	FILE E 330181
EAC		RU C-DE.*09.B.00169
CSA	http://www.csagroup.org/services-industries/product-listing/	70194378
cULus Listed		

SECTION 6.7

RVSS SMC UNIT

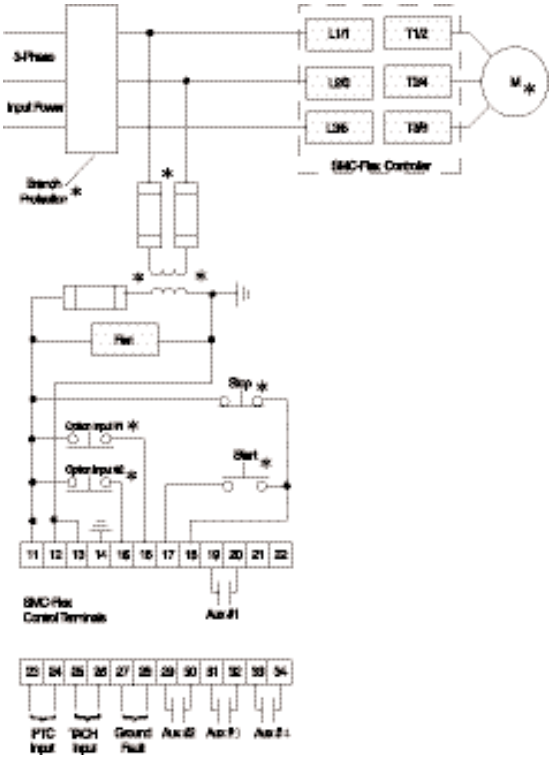
Lone Star Blower
8883 West Monroe
Houston, TX 77061

PH: 832-532-3112
FAX: 832-532-3115

Specifications

Functional Design Specifications			
Standard Features	Installation	Power Wiring	Standard squirrel-cage induction motor or a Wye-Delta, six-lead motor.
		Control Wiring	2- and 3-wire control for a wide variety of applications.
	Setup	Keypad	Front keypad and backlit LCD display.
		Software	Parameter values can be downloaded to the SMC-Flex Controller with DriveTools programming software and the Cat. No. 20-COMM… DPI communication module.
	Communications		One DPI provided for connection to optional human interface and communication modules.
	Starting and Stopping Modes		Soft Start Current Limit Start Dual Ramp Full Voltage Linear Speed Acceleration Preset Slow Speed Soft Stop
	Protection and Diagnostics		Power loss, line fault, voltage unbalance, excessive starts/hour, phase reversal, undervoltage, overvoltage, controller temp, stall, jam, open gate, overload, underload, communication fault.
	Metering		Amps, volts, kW, kWH, mW, mWH, elapsed time, power factor, motor thermal capacity usage.
	Alarm Contact		Overload, underload, undervoltage, overvoltage, unbalance, jam, stall, and ground fault
	Status Indication		Stopped, starting, stopping, at speed, alarm, and fault.
	Auxiliary Contacts		Four fully programmable contacts as normal/up-to-speed/fault/alarm/network (N.O./N.C.), or external bypass (N.O. only).
Optional Features	Pump Control		Helps reduce fluid surges in centrifugal pumping systems during starting and stopping period. Starting time is adjustable from 0…30 seconds. Stopping time is adjustable from 0…120 seconds.
	Braking Control	SMB Smart Motor Braking	Provides motor braking without additional equipment for applications that require the motor to stop quickly. Braking current is adjustable from 0…400% of the motor's full-load current rating.
		Accu-Stop	Provides controlled position stopping. During stopping, braking torque is applied to the motor until it reaches preset slow speed (7% or 15% of rated speed) and holds the motor at this speed until a stop command is given. Braking torque is then applied until the motor reaches zero speed. Braking current is programmable from 0…450% of full-load current.
		Slow Speed with Braking	Used on applications that require slow speed (in the forward direction) for positioning or alignment and also require braking control to stop.

Wiring Diagram — Line Controller



* Customer supplied.

Electrical Ratings				
		Device Rating	UL/CSA/NEMA	IEC
Power Circuit	Rated Operation Voltage	480V	200…480V AC (–15%, +10%)	200…415V
		600V	200…600V AC (–15%, +10%)	200…500V
		690V	230…600V AC (–15%, +10%)	230…690V/Y
	Rated Insulation Voltage	480V	N/A	500V
		600V		500V
		690V		690V
	Rated Impulse Voltage	480V	N/A	6000V
		600V		
		690V		
	Dielectric Withstand	480V	2200V AC	2500V
		600V		
		690V		
	Repetitive Peak Inverse Voltage Rating	480V	1400V	1400V
		600V	1600V	1600V
		690V	1800V	1800V
	Operating Frequency	All	50/60 Hz	
	Utilization Category	5…480 A	MG 1	AC-53B:3.0-50:1750
		625…1250 A	MG 1	AC-53B:3.0-50:3550
	Protection Against Electrical Shock	5…85 A	N/A	IP20
		108…480 A		IP2X (with terminal covers)
		625…1250 A		IP00 (open device)
	DV/DT Protection	480V & 600V	RC Snubber Network	
		690V	None	
	Transient Protection	480V & 600V	Metal Oxide Varistors: 220 Joules	
		690V	None	
Control Circuit	Rated Operational Voltage§	5…480 A	100…240V AC or 24V AC/DC	
		625…1250 A	110/120V AC and 230/240V AC	
	Rated Insulation Voltage	All	N/A	240V
	Rated Impulse Voltage	All	N/A	3000V
	Dielectric Withstand	All	1600V AC	2000V
	Operating Frequency	All	50/60 Hz	
	Input onstate voltage minimum		85V AC, 19.2V DC / 20.4V AC	
	Input onstate current		20 mA @120V AC / 40 mA @ 240V AC, 7.6 mA @ 24V AC/DC	
	Input offstate voltage maximum		50V AC, 10V DC / 12V AC	
	Input offstate current @ input offstate voltage		<10 mA AC, <3 mA DC	

§ 690V power is only available with 100…240V control.

Electrical Ratings								
Short Circuit Protection	SCPD Performance 200…600V		Type 1					
	SCCR List✶		Max. Standard Available Fault	Max. Standard Fuse (A)❄	Max. Standard Available Fault	Max. Circuit Breaker (A)	Max. High Fault	Max. Fuse (A) ‡
	Line Device Operational Current Rating (A)	5	10 kA	20	10 kA	20	70 kA	10
		25	10 kA	100	10 kA	100	70 kA	50
		43	10 kA	150	10 kA	150	70 kA	90
		60	10 kA	225	10 kA	225	70 kA	125
		85	10 kA	300	10 kA	300	70 kA	175
		108	18 kA	400	18 kA	300	70 kA	200
		135	18 kA	500	18 kA	400	70 kA	225
		201	30 kA	600	30 kA	600	70 kA	350
		251	30 kA	700	30 kA	700	70 kA	400
		317	42 kA	800	30 kA	800	69 kA	500
		361	42 kA	1000	30 kA	1000	69 kA	600
		480	42 kA	1200	30 kA	1200	69 kA	800
		625	42 kA	1600	42 kA	1600	74 kA	1600
		780	42 kA	1600	42 kA	2000	74 kA	1600
		970	85 kA	2500	85 kA	2500	85 kA	2500
		1250	85 kA	3000	85 kA	3200	85 kA	3000
	Delta Device Operational Current Rating (A)	8.7	10 kA	35	10 kA	35	70 kA	17.5
		43	10 kA	150	10 kA	150	70 kA	90
		74	10 kA	300	10 kA	300	70 kA	150
		104	10 kA	400	10 kA	300	70 kA	200
		147	10 kA	400	10 kA	400	70 kA	200
		187	18 kA	500	18 kA	500	70 kA	300
		234	18 kA	700	18 kA	700	70 kA	400
		348	30 kA	1000	30 kA	1000	70 kA	600
		435	42 kA	1200	30 kA	1200	70 kA	800
		549	42 kA	1600	30 kA	1600	69 kA	1000
		625	42 kA	1600	30 kA	1600	69 kA	1200
		831	42 kA	1600	30 kA	1600	69 kA	1600
		850	42 kA	1600	42 kA	2000	74 kA	1600
		900	42 kA	1600	42 kA	2000	74 kA	1600
		1200	85 kA	3000	85 kA	3200	85 kA	3000
		1600	85 kA	3000	85 kA	3200	85 kA	3000

	SCPD Performance 690V		Type 1		
	SCCR List✶	Device Rating	Max. Standard Available Fault	Max. Ampere Tested — North American Style	Max. Ampere Tested — European Style
	Maximum FLC	108	70 kA	A070URD33xxx500	6,9 gRB 73xxx400 6,6URD33xxx500
		135	70 kA	A070URD33xxx500	6,9 gRB 73xxx400 6,6URD33xxx500
		201	70 kA	A070URD33xxx700	6,9 gRB 73xxx630 6,6URD33xxx700
		251	70 kA	A070URD33xxx700	6,9 gRB 73xxx630 6,6URD33xxx700
		317	70 kA	A070URD33xxx900	6,9 gRB 73xxx800 6,6URD33xxx900
		361	70 kA	A070URD33xxx900	6,9 gRB 73xxx800 6,6URD33xxx900
		480	70 kA	A070D33xxx1250 A100URD73xxx1250	9 URD 73xxx1250 6,6URD33xxx1250
		625	70 kA	A070URD33xxx1400	6,6URD33xxx1400
		780	70 kA	A070URD33xxx1400	6,6URD33xxx1400
		970	85 kA	2 fuses in parallel A070URD33xxx1250	2 fuses in parallel 6,6URD33xxx1250
		1250	85 kA	2 fuses in parallel A070URD33xxx1250	2 fuses in parallel 6,6URD33xxx1250

✶ Consult local codes for proper sizing of short circuit protection.
❄ Non-time delay fuses (K5 — 5…480V (8.7…831 A) devices; Class L — 625…1250V (850…1600 A) devices).
‡ High capacity fault rating when used with time delay class CC, J, or L fuses.

Electrical Ratings					
Power Requirements	Control Module	1…480 A	120…240V AC	Transformer	75 VA
			24V AC	Transformer	130 VA
			24V DC	Inrush Current	5 A
				Inrush Time	250 ms
				Transient Watts	60 W
				Transient Time	500 ms
				Steady State Watts	24 W
				Minimum Allen-Bradley Power Supply	1606-XLP50E
		625…1250 A	751 VA (recommended 800 VA)		
	Heatsink Fan(s) (A)♣		5…135 A, 20 VA		
			201…251 A, 40 VA		
			317…480 A, 60 VA		
			625…1250 A, 150 VA		
Steady State Heat Dissipation with Control and Fan Power (Watts)	Controller Rating (A)	5	70		
		25	70		
		43	81		
		60	97		
		85	129		
		108	91		
		135	104		
		201	180		
		251	198		
		317	225		
		361	245		
		480	290		
		625	446		
		780	590		
		970	812		
		1250	1222		
Auxiliary Contacts 19/20 (Aux #1) 29/30 (Aux #2) 31/32 (Aux #3) 33/34 (Aux #4)	Type of Control Circuit		Electromagnetic relay		
	Number of Contacts		1		
	Type of Contacts		programmable N.O./N.C.		
	Type of Current		AC		
	Rated Operational Current		3 A @ 120V AC, 1.5 A @ 240V AC		
	Conventional Thermal Current I_{th} AC/DC		5 A		
	Make/Break VA		3600/360		
	Utilization Category		AC-15/DC		
PTC Input Ratings	Response Resistance		3400 Ω ±150 Ω		
	Reset Resistance		1600 Ω ±100 Ω		
	Short-Circuit Trip Resistance		25 Ω ±10 Ω		
	Max. Voltage at PTC Terminals (R_{PTC} = 4 kΩ)		< 7.5V		
	Max. Voltage at PTC Terminals (R_{PTC} = open)		30V		
	Max. No. of Sensors.		6		
	Max. Cold Resistance of PTC Sensor Chain		1500 Ω		
	Response Time		800 ms		
Tach Input			0…5V DC, 4.5V DC = 100% Speed		

♣ Heatsink fans can be powered by either 110/120V AC or 220/240V AC.

Environmental	
Operating Temperature Range	-5…50 °C (23…122 °F) (open) -5…40 °C (23…104 °F) (enclosed)
Storage and Transportation Temperature Range	–20…+75 °C
Altitude	2000 m (6560 ft)
Humidity	5…95% (non-condensing)
Pollution Degree	2

Mechanical			
Resistance to Vibration	Operational	All	1.0 G Peak, 0.15 mm (0.006 in.) displacement
	Non-Operational	5…480 A	2.5 G Peak, 0.38 mm (0.015 in.) displacement
		625…1250 A	1.0 G Peak, 0.15 mm (0.006 in.) displacement
Resistance to Shock	Operational	5…85 A	15 G
		108…480 A	5.5 G
		625…1250 A	4 G
	Non-Operational	5…85 A	30 G
		108…480 A	25 G
		625…1250 A	12 G
Construction	Power Poles	5…85 A	Heatsink thyristor modular design
	Power Poles	108…1250 A	Heatsink hockey puck thyristor modular design
	Control Modules		Thermoset and Thermoplastic Moldings
	Metal Parts		Plated Brass, Copper, or Painted Steel
Terminals	Power Terminals	5…85 A	Cable size — Line Upper — 2.5…95 mm² (14…3/0 AWG) Line Lower — 0.8…2.5 mm² (18…14 AWG) Load Upper — 2.5…50 mm² (14…1 AWG) Load Lower — 0.8…2.5 mm² (18…14 AWG) Tightening torque — 14.7 N•m (130 lb.-in.) Wire strip length — 18…20 mm (0.22…0.34 in.)
		108…135 A	One M10 x 1.5 diameter hole per power pole
		201…251 A	Two M10 x 1.5 diameter holes per power pole
		317…480 A	Two M12 x 1.75 diameter holes per power pole
		625…1250 A	Two 13.5 mm (0.53 in.) diameter holes per power pole
	Power Terminal Markings		NEMA, CENELEC EN50 012
	Control Terminals	M3 screw clamp	Clamping yoke connection

Other				
EMC Emission Levels	Conducted Radio Frequency Emissions Radiated Emissions		Class A Class A	
EMC Immunity Levels	Electrostatic Discharge Radio Frequency Electromagnetic Field Fast Transient Surge Transient		8 kV Air Discharge Per EN/IEC 60947-4-2 Per EN/IEC 60947-4-2 Per EN/IEC 60947-4-2	
Overload Characteristics	Current Range		Line	Delta
		5	1...5	1.7…9
		25	5...25	8.6…43
		43	8.6...43	14.8…75
		60	12...60	20.8…104
		85	17...85	29.4…147
		108	27…108	47…187
		135	34…135	59…234
		201	67…201	116…348
		251	84…251	145…435
		317	106…317	183…549
		361	120…361	208…625
		480	160…480	277…831
		625	208…625	283…850
		780	260…780	300…900
		970	323…970	400…1200
		1250	416…1250	533…1600
	Trip Classes Trip Current Rating Number of Poles		10, 15, 20, and 30 117% of Motor FLC 3	
Certifications	Open Type Controllers		CE Marked Per Low Voltage Directive 73/23/EEC, 93/68/EEC UL Listed (File No. E96956)	

SECTION 6.8

RVSS CIRCUIT BREAKER

Lone Star Blower
8883 West Monroe
Houston, TX 77061

PH: 832-532-3112
FAX: 832-532-3115

140G-M5F3-D80

Cat. No. 140G-G6C3-D12

Bulletin 140G Molded Case Circuit Breakers

- 10..3000 A current range
- 3- & 4-pole devices
- Space-saving dimensions
- Thermal/Magnetic protection: 15..800 A
- Electronic protection: 10..3000 A
- Approved for global application: UL, CSA, CCC, and IEC performance interrupting/breaking capacity
- Wide range of mounting options
- Extensive range of factory- or field-installed accessories

The Bulletin 140G family of Molded Case Circuit Breakers (MCCBs) offers a wide range of features include thermal/magnetic and electronic protection devices, high interrupting/breaking capacities and a complete line of factory and field installed accessories. The Bulletin 140G MCCBs are ideal for use in line protection of control panels.

Table of Contents

Standards Compliance

IEC 60947-2
UL489
CSA22.2, No. 5

Certifications

CE Marked
CCC
CSA Certified
UL Listed

G-Frame

H-Frame

I-Frame

J-Frame

K-Frame

M-Frame

N-, NS-Frame

R-Frame

Frame Reference	G-Frame	H-Frame	I-Frame	J-Frame	K-Frame	M-Frame	N-Frame	NS-Frame	R-Frame
Rated Current I_n	125 A	125 A	225 A	250 A	400 A	800 A	1200 A	1200 A	3000 A
No. of Poles	3, 4	3, 4	3, 4	3, 4	3, 4	3, 4	3, 4	3, 4	3, 4
Interrupting Rating [kA]									
240V	50 65 100	65 100 150 200 200	50 65	65 100 150 200	100 150 200 200	100 200 200	65 100 150	65 100 150	125
480V	25 35 65	25 35 65 100 150	25 35	25 35 65 100	35 65 100 150	50 65 100	50 65 100	50 65 100	125
600Y/347V	10 14 25	—	10 10	—	—	—	—	—	—
600V	—	14 18 25 35	10 10	14 18 25 35	25 35 65 100	25 35 42	25 50 65	25 50 65	100
Breaking Capacity [I_{cu} (kA)]									
220…240V	65 85 100	65 85 100 150 200	65 85	65 85 100 150	85 100 200 200	85 100 200	85 100 200	85 100 200	130
415V	36 50 70	36 50 70 120 150	36 50	36 50 70 120	50 70 120 200	36 70 100	50 70 120	50 70 120	80
440V	36 50 65	36 50 65 100 150	25 40	36 50 65 100	40 65 100 180	35 50 65	50 65 100	50 65 100	80
690V	6 8 10	10 12 15 18 20	5 8	10 12 15 20	25 40 70 80	22 25 30	30 42 50	30 42 50	40
250V DC	36 50 70	36 50 70 85 100	36 50	36 50 70 85	—	36 50 65	—	—	—
500V DC	36 50 70	36 50 70 85 100	36 50	36 50 70 85	36 50 70 100	—	—	—	—
750V DC	—	—	—	—	25 36 70 70	16 36 50	—	—	—
Protection Type									
Thermal Magnetic	✓	✓	✓	✓	✓	✓	—	—	—
Electronic	—	✓	—	✓	✓	✓	✓	✓	✓
Molded Case Switch	✓	✓	✓	✓	✓	✓	✓	✓	✓
Internal Accessories									
Auxiliary Contact	✓	✓	✓	✓	✓	✓	✓	✓	✓
Alarm Contact	✓	✓	✓	✓	✓	✓	✓	✓	✓
AX/AL Combo	✓	✓	✓	✓	✓	✓	✓	✓	✓
Trip Unit Contact	—	✓	—	✓	—	—	✓	✓	✓
Shunt Trip	✓	✓	✓	✓	✓	✓	✓	✓	✓
Shunt Close	—	—	—	—	—	—	✓	✓	✓
UV Relay	✓	✓	✓	✓	✓	✓	✓	✓	✓
Field Installable	✓	✓	✓	✓	✓	✓	✓	✓	✓
External Accessories									
End Cap	STD	STD	STD	STD	STD	STD	STD	STD	—
25 mm Phase Barriers	STD	STD	STD	STD	STD	—	—	—	—
Insulators	STD	STD	STD	STD	STD	STD	—	—	—
Terminal Lugs	✓	✓	✓	✓	✓	✓	✓	✓	✓
Extended Terminal	✓	✓	✓	✓	✓	✓	✓	✓	—
Spreader Terminal	✓	✓	✓	✓	✓	✓	✓	✓	✓
Rear Terminal	—	—	—	—	—	—	✓	✓	✓
Phase barriers	✓	✓	✓	✓	✓	✓	✓	✓	✓
Terminal Cover	✓	✓	✓	✓	✓	✓	✓	✓	—
Direct Rotary	✓	✓	✓	✓	✓	✓	✓	—	—
Variable Depth (Door)	✓	✓	✓	✓	✓	✓	✓	—	—
Internal NFPA 79	✓	✓	✓	✓	✓	✓	✓	—	—
Flange Operator	✓	✓	✓	✓	✓	✓	✓	—	—
Flange Cable	✓	✓	✓	✓	✓	✓	✓	—	—
Motor Operator	✓	✓	✓	✓	✓	✓	—	✓	✓
Field Installable	✓	✓	✓	✓	✓	✓	✓	✓	✓

140G-M5F3-D80

Complete Circuit Breaker Assemblies — 800 A, M-Frame

Examples given in this section are not intended to be used for product selection. Use ProposalWorks to configure the molded case circuit breaker. Use these configurations only to select all factory-installed options for shunt trips, undervoltage release units, auxiliary contacts, and alarm contacts. Use the codes from Table g to add on to the molded case circuit breaker cat. no. selected on the previous pages to form a complete cat. no. for a complete assembly with factory-installed options.

140G	–	M		6		K		3	–	D60	–	SD	–	AA
		a	*b*	*c*	*d*	*e*	*f*	*g*						

a

Bulletin No.	
Code	Description
140G	Global Molded Case Circuit Breaker

b

Frame/Rating	
Code	Description
M	800 A

c

Interrupting Rating/Breaking Capacity (based on I_c at 480V)	
Code	Description
5	50 kA
6	65 kA
0	100 kA
T	Trip unit

d

Protection Type	
Code	Description
F	Adjust thermal/ adjust magnetic
H	Electronic LSI -long, short, instant
I	Electronic LSIG -long, short, instant & ground fault
K	Electronic LSIG-MM -long, short, instant, ground fault & MM
X	Breaker frame
S	Molded case switch (isolator)

e

Poles	
Code	Description
3	3 poles
4	4 poles

f

Current Range	
Code	Description
D60	e.g., 600 A
D63	e.g., 630 A
D80	e.g., 800 A
Blank	Frame only

g

Factory-Installed Internal Options♦	
Shunt Trip and Undervoltage Release Units	
Code	Description
SJ	Shunt Trip, 24…30V AC/DC
SK	Shunt Trip, 48…60V AC/DC
SD	Shunt Trip, 110…127V AC; 110…125V DC
SA	Shunt Trip, 220…240V AC; 220…250V DC
SB	Shunt Trip, 380…440V AC
SC	Shunt Trip, 480…525V AC
UJ	Undervoltage Release, 24…30V AC/DC
UR	Undervoltage Release, 48V AC/DC
UY	Undervoltage Release, 60V AC/DC
UD	Undervoltage Release, 110…127V AC; 110…125V DC
UA	Undervoltage Release, 220…240V AC; 220…250V DC
UB	Undervoltage Release, 380…440V AC
UC	Undervoltage Release, 480…525V AC
No Digit	No Selection
Auxiliary and Alarm Contacts, Trip Units	
Code	Description
AA	1 Aux., 1 Alarm Contact, 250V
CA	3 Aux., 1 Alarm Contact, 250V
FB	2 Aux. Contacts, 400V
AB	1 Aux., 1 Alarm Contact, 400V
CJ	3 Aux., 1 Alarm Contact, 24V

♦ Select up to two internal options: 1 for left side mounting (shunt trip or undervoltage release), 1 for right (auxiliary or alarm contact). Consult your local Rockwell automation sales office or Allen-Bradley distributor for further assistance.

Breaker Frames & Trip Units

Breaker Frames, 800 A Rated Current

Interrupting Rating (50/60 Hz), UL 489/CSA C22.2-5, No. 5-02 [kA]				Breaking Capacity (50/60 Hz), IEC 60947-2						Breaking Capacity (DC), IEC 60947-2 §		Cat. No.	
			3-Pole in series	220V★		415V		690V		750V DC (3-pole in series)			
240V	480V	600V	600V DC	I_{cu} [kA]	I_{cs} [%I_{cu}]	I_{cu} [kA]	I_{cs} [%I_{cu}]	I_{cu} [kA]	I_{cs} [%I_{cu}]	I_{cu} [kA]	I_{cs} [%I_{cu}]	3 Poles	4 Poles
100	50	25	20	85	100	50	100	22	75	16	75	140G-M5X3	140G-M5X4
200	65	35	35	100	100	70	100	25	75	36	75	140G-M6X3	140G-M6X4
200	100	42	50	200	75	100	75	30	75	50	75	140G-M0X3	140G-M0X4

★ These ratings have not been tested for the CCC listing.
‡ See table below for Cat. No. selection
§ DC rating is applicable for thermal-magnetic trip unit only.

Trip Units, Thermal-Magnetic

Rated Current I_n [A]	Thermal Trip [A] $I_r = I_n$	Magnetic Trip [A] I_m	Protection Type	Cat. No.	
				3 Poles	4 Poles
600	420…630	3000…6000	F (Adjustable Thermal/ Adjustable Magnetic)	140G-MTF3-D60	140G-MTF3-D60
800	560…800	4000…8000	F (Adjustable Thermal/ Adjustable Magnetic)	140G-MTF3-D80	140G-MTF4-D80

Trip Units, Electronic LSI (Long, Short, Instantaneous)

Rated Current I_n [A]	Protection Type					Cat. No.	
	L		S		I		
	I_1=0.4…1 x I_n	t_1=sec.	I_2=0.6…10 x I_n	t_2=sec.	I_3=1.5…12 x I_n	3 Poles	4 Poles
600	240…600	3, 6, 9, 18	360…6000	0.05, 0.1, 0.25, 0.5	900…7200	140G-MTH3-D60	140G-MTH4-D60
800	320…800	3, 6, 9, 18	480…8000	0.05, 0.1, 0.25, 0.5	800…8400	140G-MTH3-D80	140G-MTH4-D80

Trip Units, Electronic LSIG (Long, Short, Instantaneous, Ground Fault)

Rated Current I_n [A]	Protection Type							Cat. No.	
	L		S		I	G			
	I_1=0.4…1 x I_n	t_1=sec.	I_2=0.6…10 x I_n	t_2=sec.	I_3=1.5…12 x I_n	I_4=0.2…1 x I_n	t_4=sec.	3 Poles	4 Poles
600	240…600	3, 6, 9, 18	360…6000	0.05, 0.1, 0.25, 0.5	900…7200	120…600	0.1, 0.2, 0.4, 0.8	140G-MTI3-D60	140G-MTI4-D60
800	320…800	3, 6, 9, 18	480…8000	0.05, 0.1, 0.25, 0.5	800…8400	160…800	0.1, 0.2, 0.4, 0.8	140G-MTI3-D80	140G-MTI4-D80

Trip Units, Electronic LSIG-MM (Long, Short, Instantaneous, Ground Fault - Maintenance Mode)

Rated Current I_n [A]	Protection Type							Cat. No.	
	L		S		I	G			
	I_1=0.4…1 x I_n	t_1=sec.	I_2=0.6…10 x I_n	t_2=sec.	I_3=1.5…12 x I_n	I_4=0.2…1 x I_n	t_4=sec.	3 Poles	4 Poles
600	240…600	3, 6, 9, 18	360…6000	0.05, 0.1, 0.25, 0.5	900…7200	120…600	0.1, 0.2, 0.4, 0.8	140G-MTK3-D60	140G-MTK4-D60
800	320…800	3, 6, 9, 18	480…8000	0.05, 0.1, 0.25, 0.5	800…8400	160…800	0.1, 0.2, 0.4, 0.8	140G-MTK3-D80	140G-MTK4-D80

Assembled molded case circuit breakers found on pages 28…30

Assembled Molded Case Circuit Breakers — 800 A M-Frame

Interrupting Rating/Breaking Capacity — Thermal-Magnetic Circuit Breakers

Interrupting Rating (50/60 Hz), UL 489/CSA C22.2-5, No. 5-02 [kA]				Breaking Capacity (50/60 Hz), IEC 60947-2						Breaking Capacity (DC), IEC 60947-2		Interrupting Code‡
			3-Pole in series	220V★		415V		690V		750V DC (3-pole in series)		
240V	480V	600V	600V DC	I_{cu} [kA]	I_{cs} [%I_{cu}]	I_{cu} [kA]	I_{cs} [%I_{cu}]	I_{cu} [kA]	I_{cs} [%I_{cu}]	I_{cu} [kA]	I_{cs} [%I_{cu}]	
100	50	25	20	85	100	50	100	22	75	16	75	M5
200	65	35	35	100	100	70	100	25	75	36	75	M6
200	100	42	50	200	75	100	75	30	75	50	75	M0

★ These ratings have not been tested for the CCC listing.
‡ See table below for Cat. No. selection

Thermal-Magnetic, Adjustable & Adjustable

Rated Current I_n [A]	Thermal Trip [A] $I_r = I_n$	Magnetic Trip [A] I_m	Protection Type	Interrupting Code M5 Cat. No.		Interrupting Code M6 Cat. No.		Interrupting Code M0 Cat. No.	
				3 Poles	4 Poles	3 Poles	4 Poles	3 Poles	4 Poles
600	420…630	3000…6000	F (Adjustable Thermal/ Adjustable Magnetic)	140G-M5F3-D60	140G-M5F4-D60	140G-M6F3-D60	140G-M6F4-D60	140G-M0F3-D60	140G-M0F4-D60
630 §	441…630	3150…6300		140G-M5F3-D63	140G-M5F4-D63	140G-M6F3-D63	140G-M6F4-D63	140G-M0F3-D63	140G-M0F4-D63
800	560…800	4000…8000		140G-M5F3-D80	140G-M5F4-D80	140G-M6F3-D80	140G-M6F4-D80	140G-M0F3-D80	140G-M0F4-D80

§ IEC only.

Interrupting Rating/Breaking Capacity — Electronic Circuit Breakers

Interrupting Rating (50/60 Hz), UL 489/CSA C22.2-5, No. 5-02 [kA]				Breaking Capacity (50/60 Hz), IEC 60947-2						Breaking Capacity (DC), IEC 60947-2		Interrupting Code‡
			3-Pole in series	220V★		415V		690V		750V DC (3-pole in series)		
240V	480V	600V	600V DC	I_{cu} [kA]	I_{cs} [%I_{cu}]	I_{cu} [kA]	I_{cs} [%I_{cu}]	I_{cu} [kA]	I_{cs} [%I_{cu}]	I_{cu} [kA]	I_{cs} [%I_{cu}]	
100	50	25	20	85	100	50	100	22	75	16	75	M5
200	65	35	35	100	100	70	100	25	75	36	75	M6
200	100	42	50	200	75	100	75	30	75	50	75	M0

★ These ratings have not been tested for the CCC listing.

‡ See table below for Cat. No. selection

Electronic LSI (Long, Short, Instantaneous)

Rated Current I_n [A]	Protection Type					Interrupting Code M5		Interrupting Code M6	
	L		S		I	Cat. No.		Cat. No.	Cat. No.
	I_1=0.4…1 x I_n	t_1=sec.	I_2=1…10 x I_n	t_2=sec.	I_3=1…10 x I_n	3 Poles	4 Poles	4 Poles	3 Poles
600	240…600	3, 6, 9, 18	360…6000	0.05, 0.1, 0.25, 0.5	900…7200	140G-M5H3-D60	140G-M5H4-D60	140G-M6H3-D60	140G-M6H4-D60
630 §	252…630	3, 6, 9, 18	378…6300	0.05, 0.1, 0.25, 0.5	945…7560	140G-M5H3-D63	140G-M5H4-D63	140G-M6H3-D63	140G-M6H4-D63
800	320…800	3, 6, 9, 18	480…8000	0.05, 0.1, 0.25, 0.5	800…8400	140G-M5H3-D80	140G-M5H4-D80	140G-M6H3-D80	140G-M6H4-D80

§ IEC only.

Rated Current I_n [A]	Protection Type					Interrupting Code M0	
	L		S		I	Cat. No.	
	I_1=0.4…1 x I_n	t_1=sec.	I_2=1…10 x I_n	t_2=sec.	I_3=1…10 x I_n	3 Poles	4 Poles
600	240…600	3, 6, 9, 18	360…6000	0.05, 0.1, 0.25, 0.5	900…7200	140G-M0H3-D60	140G-M0H4-D60
630 §	252…630	3, 6, 9, 18	378…6300	0.05, 0.1, 0.25, 0.5	945…7560	140G-M0H3-D63	140G-M0H4-D63
800	320…800	3, 6, 9, 18	480…8000	0.05, 0.1, 0.25, 0.5	800…8400	140G-M0H3-D80	140G-M0H4-D80

§ IEC only.

Electronic LSIG (Long, Short, Instantaneous, Ground Fault)

Rated Current I_n [A]	Protection Type							Interrupting Code M5		Interrupting Code M6	
	L		S		I	G		Cat. No.		Cat. No.	
	I_1=0.4…1 x I_n	t_1=sec.	I_2=1…10 x I_n	t_2=sec.	I_3=1…10 x I_n	I_4=0.2…1 x I_n	t_4=sec.	3 Poles	4 Poles	3 Poles	4 Poles
600	240…600	3, 6, 9, 18	360…6000	0.05, 0.1, 0.25, 0.5	900…7200	120…600	0.1, 0.2, 0.4, 0.8	140G-M5I3-D60	140G-M5I4-D60	140G-M6I3-D60	140G-M6I4-D60
630 §	252…630	3, 6, 9, 18	378…6300	0.05, 0.1, 0.25, 0.5	945…7560	126…630	0.1, 0.2, 0.4, 0.8	140G-M5I3-D63	140G-M5I4-D63	140G-M6I3-D63	140G-M6I4-D63
800	320…800	3, 6, 9, 18	480…8000	0.05, 0.1, 0.25, 0.5	800…8400	160…800	0.1, 0.2, 0.4, 0.8	140G-M5I3-D80	140G-M5I4-D80	140G-M6I3-D80	140G-M6I4-D80

§ IEC only.

Rated Current I_n [A]	Protection Type							Interrupting Code M0	
	L		S		I	G		Cat. No.	
	I_1=0.4…1 x I_n	t_1=sec.	I_2=1…10 x I_n	t_2=sec.	I_3=1…10 x I_n	I_4=0.2…1 x I_n	t_4=sec.	3 Poles	4 Poles
600	240…600	3, 6, 9, 18	360…6000	0.05, 0.1, 0.25, 0.5	900…7200	120…600	0.1, 0.2, 0.4, 0.8	140G-M0I3-D60	140G-M0I4-D60
630 §	252…630	3, 6, 9, 18	378…6300	0.05, 0.1, 0.25, 0.5	945…7560	126…630	0.1, 0.2, 0.4, 0.8	140G-M0I3-D63	140G-M0I4-D63
800	320…800	3, 6, 9, 18	480…8000	0.05, 0.1, 0.25, 0.5	800…8400	160…800	0.1, 0.2, 0.4, 0.8	140G-M0I3-D80	140G-M0I4-D80

§ IEC only.

Electronic LSIG-MM (Long, Short, Instantaneous, Ground Fault - Maintenance Mode)

Rated Current I_n [A]	Protection Type							Interrupting Code M5		Interrupting Code M6	
	L		S		I	G		Cat. No.		Cat. No.	
	I_1=0.4…1 x I_n	t_1=sec.	I_2=1…10 x I_n	t_2=sec.	I_3=1…10 x I_n	I_4=0.2…1 x I_n	t_4=sec.	3 Poles	4 Poles	3 Poles	4 Poles
600	240…600	3, 6, 9, 18	360…6000	0.05, 0.1, 0.25, 0.5	900…7200	120…600	0.1, 0.2, 0.4, 0.8	140G-M5K3-D60	140G-M5K4-D60	140G-M6K3-D60	140G-M6K4-D60
630 §	252…630	3, 6, 9, 18	378…6300	0.05, 0.1, 0.25, 0.5	945…7560	126…630	0.1, 0.2, 0.4, 0.8	140G-M5K3-D63	140G-M5K4-D63	140G-M6K3-D63	140G-M6K4-D63
800	320…800	3, 6, 9, 18	480…8000	0.05, 0.1, 0.25, 0.5	800…8400	160…800	0.1, 0.2, 0.4, 0.8	140G-M5K3-D80	140G-M5K4-D80	140G-M6K3-D80	140G-M6K4-D80

§ IEC only.

Rated Current I_n [A]	Protection Type							Interrupting Code M0	
	L		S		I	G		Cat. No.	
	I_1=0.4…1 x I_n	t_1=sec.	I_2=1…10 x I_n	t_2=sec.	I_3=1…10 x I_n	I_4=0.2…1 x I_n	t_4=sec.	3 Poles	4 Poles
600	240…600	3, 6, 9, 18	360…6000	0.05, 0.1, 0.25, 0.5	900…7200	120…600	0.1, 0.2, 0.4, 0.8	140G-M0K3-D60	140G-M0K4-D60
630 §	252…630	3, 6, 9, 18	378…6300	0.05, 0.1, 0.25, 0.5	945…7560	126…630	0.1, 0.2, 0.4, 0.8	140G-M0K3-D63	140G-M0K4-D63
800	320…800	3, 6, 9, 18	480…8000	0.05, 0.1, 0.25, 0.5	800…8400	160…800	0.1, 0.2, 0.4, 0.8	140G-M0K3-D80	140G-M0K4-D80

§ IEC only.

Maintenance Mode (MM)

Maintenance Mode (MM) offers a preset set of protection parameters. MM allows systems testing when the molded case circuit breaker is energized or ON. This feature is a manual adjustment on the molded case circuit breaker, via a DIP switch. The following table illustrates the preset values for Maintenance Mode.

Rated Current I_n [A]	L		S		I	G		MM
	I_1=1 x I_n	t_1=MAX sec.	I_2=OFF	t_2=OFF sec.	I_3=4 x I_n	I_4=OFF	t_4=OFF sec.	I_5=2.5 x I_n
600	600	18	—	—	2400	—	—	1500
630 §	630	18	—	—	2520	—	—	1575
800	800	18	—	—	3200	—	—	2000

§ IEC only.

Molded Case Switch — UL489

Rated Current I_n [A]	Magnetic Trip [A] I_m	Cat. No.	
		3 Poles	4 Poles
800	10 000	140G-M6S3-D80	140G-M6S4-D80

Accessories Table of Contents

Internal Electrical Accessories

Auxiliary/Alarm Contact (AX/AL)

Auxiliary and alarm contacts are supplied in multiple variations for customer application.

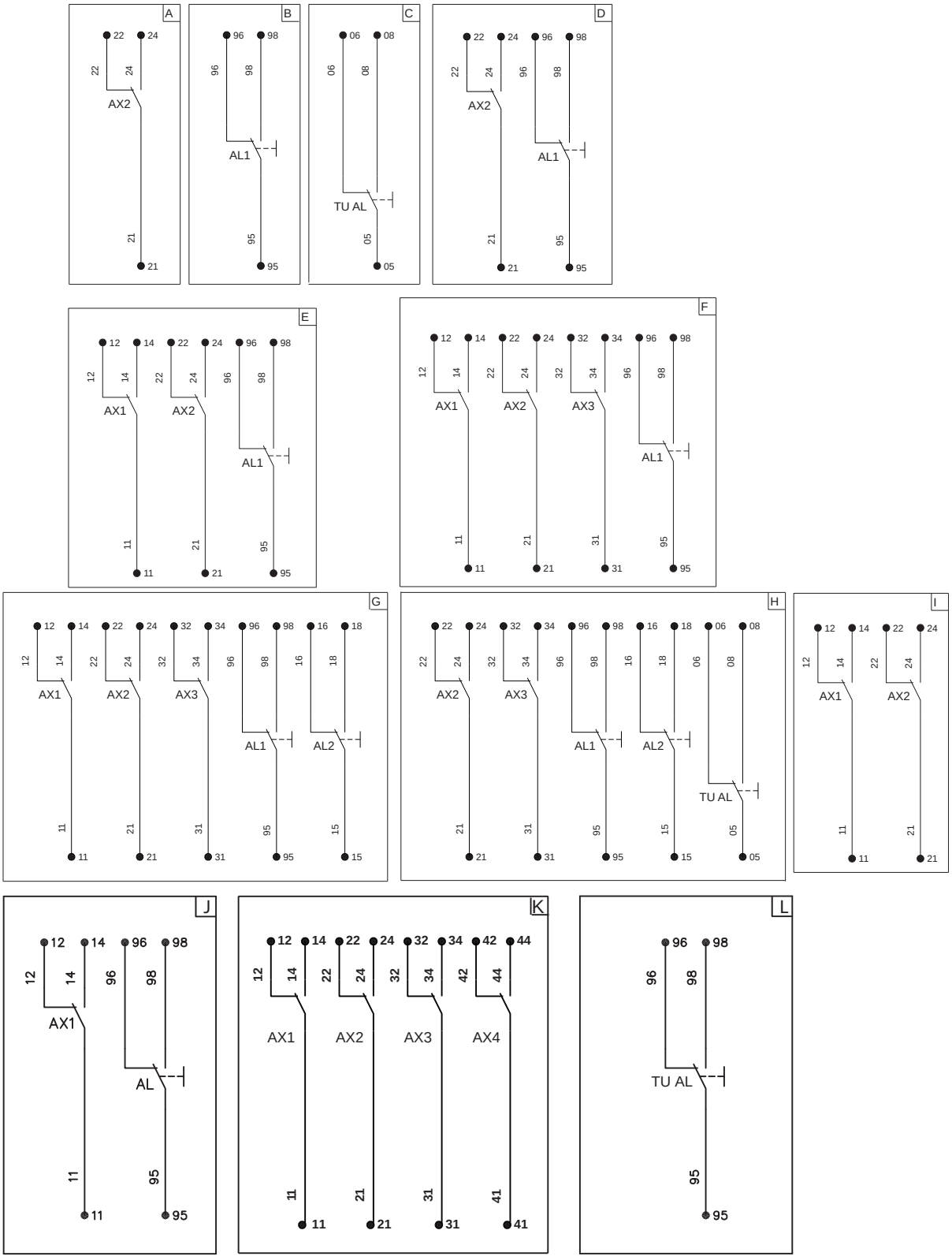
- Auxiliary Contacts (AX) : Indicate ON/OFF status of the MCCB.
- Alarm Contacts (AL): Indicate trip status of the MCCB. Alarm trip can be initiated by pressing the test button on the molded case circuit breaker, a trip due to overcurrent, short circuit; or trip due to residual current, shunt, or undervoltage release signals.
- Thermal Trip Contacts (TU): Trips only when the MCCB has detected an overcurrent, short-circuit, or protection trip. H- and J-Frame MCCBs have a button to test this feature. Available only for H, J, N, NS, and R frames.

These contacts are installed by removing the MCCB cover and accessing right-side pockets within the breaker with snap-in mounting provisions. Frames G…M are supplied with pig tail wiring, with each terminal wire marked. Frames N, NS, and R are wired internal to the breaker and are terminated for connection using a 3-pin quick connector.

	Description	Designation	Diagram	Frame Size	Cat. No.
	(1) TU Alarm Contact 250V	TU AL	C	H, J	140G-H-EA1TA
	(1) Auxiliary (1) Alarm Contact 250V	AX2/AL1	D	G, H, I, J	140G-G-EA1R1A
	(2) Auxiliary (1) Alarm Contact 250V	AX1/AX2/AL1	E	G, H, I, J	140G-G-EA2R1A
	(3) Auxiliary (1) Alarm Contact 250V	AX1/AX2/AX3/AL1	F	H, I, J	140G-H-EA3R1A
	(3) Auxiliary (2) Alarm Contact 250V	AX1/AX2/AX3/AL1/AL2	G	H, J	140G-H-EA3R2A
	(2) Auxiliary (2) Alarm (1) TU AL Contact 250V	AX2/AX3/AL1/AL2/TU AL	H	H, J	140G-H-EA2R2TA
	(1) Auxiliary Contact 250V	AX2	A	G, H, I, J	140G-G-EA1A
	(1) Auxiliary Contact 250V or (1) Alarm Contact 250V	AX2	A	G, H, I, J	140G-G-EA1AU★
		AL1	B		
	(1) Auxiliary Contact 24V	AX2	A	G, H, I, J	140G-G-EA1J★
	(1) TU Alarm Contact 24V	TU AL	C	H, J	140G-H-EA1TJ
	(1) Auxiliary (1) Alarm Contact 24V	AX2/AL1	D	G, H, I, J	140G-G-EA1R1J
	(3) Auxilary (1) Alarm Contact, 24V	AX1/AX2/AX3/AL1	F	H, I, J	140G-H-EA3R1J
	(1) Auxilary (1) Alarm Contact, 400V	AX2/AL1	D	H, J	140G-H-EA1R1B
	(2) Auxiliary Contact 400V	AX1/AX2	I	H, J	140G-H-EA2B
	(1) Auxiliary (1) Alarm Contact 250V	AX1/AL1	J	K, M	140G-K-EA1R1A
	(3) Auxiliary (1) Alarm Contact 250V	AX1/AX2/AX3/AL1	F	K, M	140G-K-EA3R1A
	(3) Auxiliary (1) Alarm Contact 24V	AX1/AX2/AX3/AL1	F	K, M	140G-K-EA3R1J
	(1) Auxiliary (1) Alarm Contact 400V	AX1/AL1	J	K, M	140G-K-EA1R1B
	(2) Auxiliary Contact 400V	AX1/AX2	I	K, M	140G-K-EA2B
	(1) Auxiliary (1) Alarm Contact 24V	AX2/AL1	D	N	140G-N-EA1R1J
	(2) Auxiliary Contact 24V	AX1/AX2	I	N, NS	140G-N-EA2J
	(1) Auxiliary (1) Alarm Contact 400V	AX2/AL1	D	N	140G-N-EA1R1B
	(2) Auxiliary Contact 400V	AX1/AX2	I	N, NS	140G-N-EA2B
	(1) TU Alarm Contact 250V	TU AL	C	N, NS	140G-N-EA1TA
	(4) Auxiliary Contact 24V	AX1/AX2/AX3/AX4	K	R	140G-R-EA4J
	(4) Auxiliary Contact 400V	AX1/AX2/AX3/AX4	K	R	140G-R-EA4A
Representative Photo	(1) TU Alarm Contact 250V	TU AL	L	R	140G-R-EA1TA

★ This contact is supplied with unmarked wires. Contact can function as either an auxiliary or alarm contact, depending on connection method.

Diagrams


A
22
24
AX2
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B
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AL1
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AX2
AX3
AX4
L
TU AL

Replacement Parts

	Description	Frame Size	3-Pole Cat. No.	4-Pole Cat. No.
 *Representative Photo*	**Replacement End Cap Kits** End Caps are supplied as standard for G, H,I,J,K,M,N & NS frames. Provide connections for ring type or bolt-on terminals.	G	140G-G-ECM	140G-G-ECM4
		H	140G-H-ECM	140G-H-ECM4
		I	140G-I-ECM	140G-I-ECM4
		J	140G-J-ECM	140G-J-ECM4
		K	140G-K-ECM	140G-K-ECM4
		M	140G-M-ECM	140G-M-ECM4
		N	140G-N-ECM	140G-N-ECM4
 *Representative Photo*	**Insulators** Supplied as standard for G, H, I, J, K, and M frames. Provide insulating barrier for MCCB applications, required for all applications with a Ue>440V. Pkg Qty 10.	H	140G-H-BP3	140G-H-BP4
		J	140G-J-BP3	140G-J-BP4
		K	140G-K-BP3	140G-K-BP4
		M	140G-M-BP3	140G-M-BP4

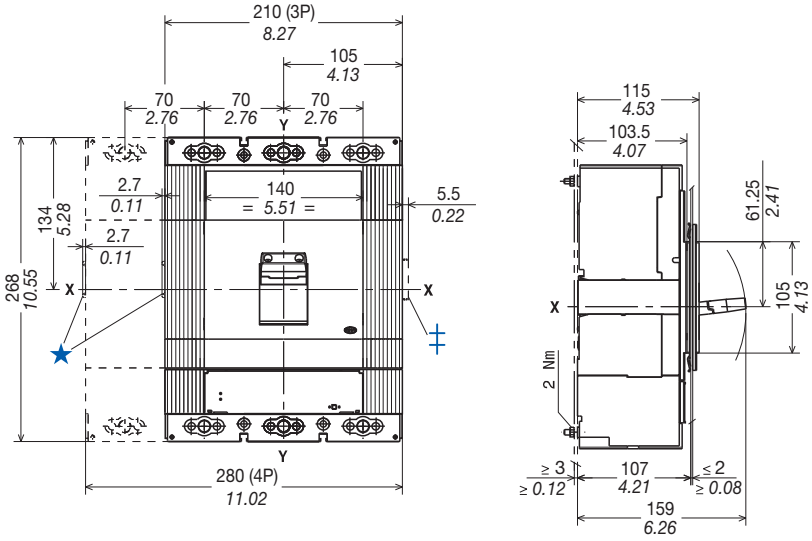
Molded Case Circuit Breakers

Specifications — K- and M-Frame

		K-Frame				M-Frame		
Max. Rated Current	[A]	400				800		
Rated insulation voltage, U_i, IEC	[V]	1000				1000		
NEMA, UL, CSA								
Interrupting Rating Code		K3	K6	K0	K15	K5	K6	K0
240V AC, 50/60Hz	[kA]	100	150	200	200	100	200	200
480V AC, 50/60Hz	[kA]	35	65	100	150	50	65	100
600Y/347V AC, 50/60Hz	[kA]	—	—	—	—	—	—	—
600V AC, 50/60 Hz	[kA]	25	35	65	100	25	35	42
IEC 60947-2								
Rated ultimate short-circuit breaking capacity, I_{cu}								
220/230/240V AC, 50/60Hz	[kA]	85	100	200	200	85	100	200
380V AC, 50/60Hz	[kA]	50	70	120	200	50	70	100
415V AC, 50/60Hz	[kA]	50	70	120	200	50	70	100
440V AC, 50/60Hz	[kA]	40	65	100	180	45	50	80
500V AC, 50/60Hz	[kA]	30	50	85	150	35	50	65
525V AC, 50/60Hz	[kA]	—	—	—	—	—	—	—
690V AC, 50/60Hz	[kA]	25	40	70	80	22	25	30
250V DC, 2 Poles in Series	[kA]	—	—	—	—	—	—	—
500V DC, 2 Poles in Series	[kA]	36	50	70	100	—	—	—
500V DC, 3 Poles in Series	[kA]	—	—	—	—	—	—	—
750V DC, 3 Poles in Series	[kA]	25	36	70	70	20	36	50
Rated service short-circuit breaking capacity, I_{cs}								
220/230/240V AC, 50/60Hz	[kA]	100%	100%	100%	100%	100%	100%	75%
380V AC, 50/60Hz	[kA]	100%	100%	100%	100%	100%	100%	75%
415V AC, 50/60Hz	[kA]	100%	100%	100%	100%	100%	100%	75%
440V AC, 50/60Hz	[kA]	100%	100%	100%	100%	100%	100%	75%
500V AC, 50/60Hz	[kA]	100%	100%	100%	100%	100%	100%	75%
525V AC, 50/60Hz	[kA]	—	—	—	—	—	—	—
690V AC, 50/60Hz	[kA]	100%	100%	100%	100%	75%	75%	75%
250V DC, 2 Poles in Series	[kA]	—	—	—	—	—	—	—
500V DC, 2 Poles in Series	[kA]	100%	100%	100%	100%	—	—	—
500V DC, 3 Poles in Series	[kA]	—	—	—	—	—	—	—
750V DC, 3 Poles in Series	[kA]	100%	100%	100%	100%	75%	75%	75%
Mechanical Life	[No. Ops]	20000				20000		
	[Ops/hr]	120				120		
Electrical Life @ 415V AC	[No. Ops]	7000 (400 A) - 5000 (630 A)				7000 (630 A) - 5000 (800 A) - 4000 (1000 A)		
	[Ops/hr]	60				60		
Ambient Temp. w/out derating	°F [°C]	104 °F [40 °C]				104 °F [40 °C]		
Storage Temperature	°F [°C]	-40...+176 °F [-40…+80 °C]				-40...+176 °F [-40…+80 °C]		
Dimensions [Width/Depth/Height]	[mm]	3 poles: 140x108.5x205				3 poles: 210x103.5x268		
	[mm]	4 poles: 185x103.5x205				4 poles: 280x103.5x268		

Dimensions are in millimeters (inches). Dimensions are not intended to be used for manufacturing purposes.

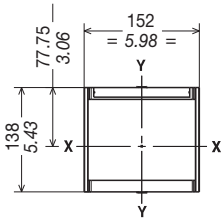
Panel Mounted Molded Case Circuit Breaker



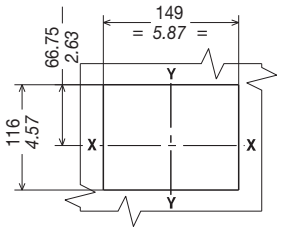
★ Overall dimensions with cabled accessories mounted
‡ Overall dimensions with cabled auxiliary contacts mounted

Drilling Templates for Molded Case Circuit Breaker Mounting

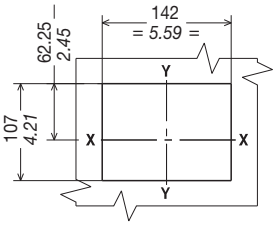
Flange for compartment door



Drilling template for compartment door

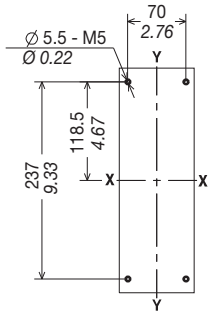


with flange

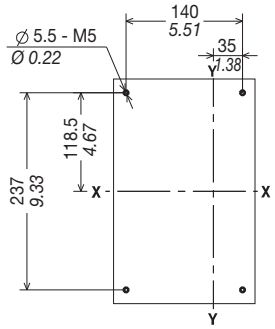


without flange

Drilling template for mounting plate



3 Poles

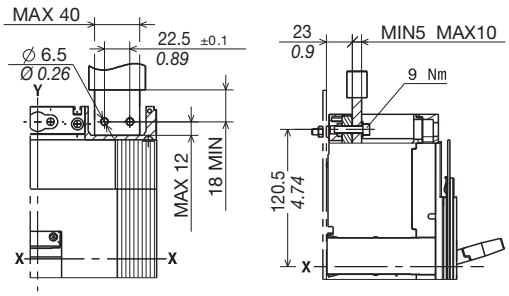


4 Poles

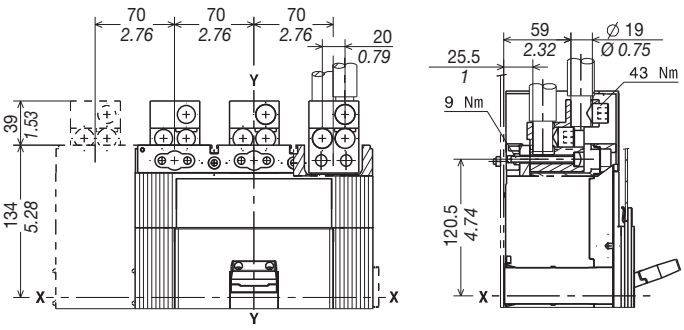
Molded Case Circuit Breakers

Approximate Dimensions — 800 A, M-Frame

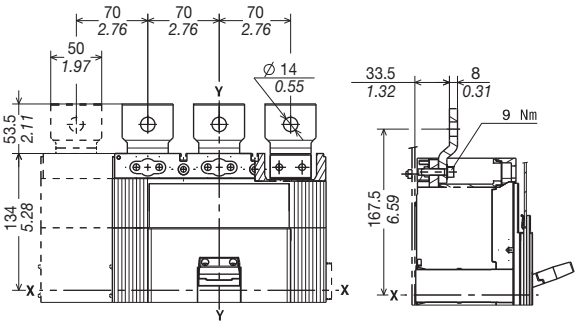
Cat. No. 140G-M-ECM Terminals



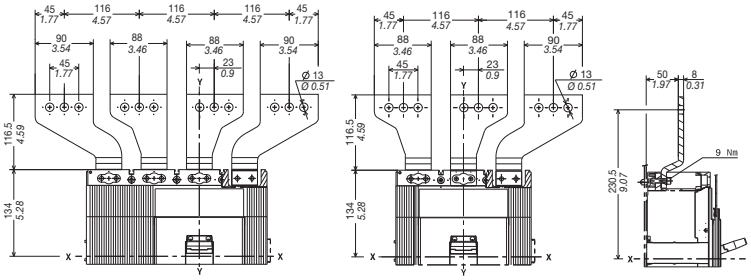
Cat. No. 140G-M-TLA23, -TLA24, -TLC23, -TLC24 Terminals



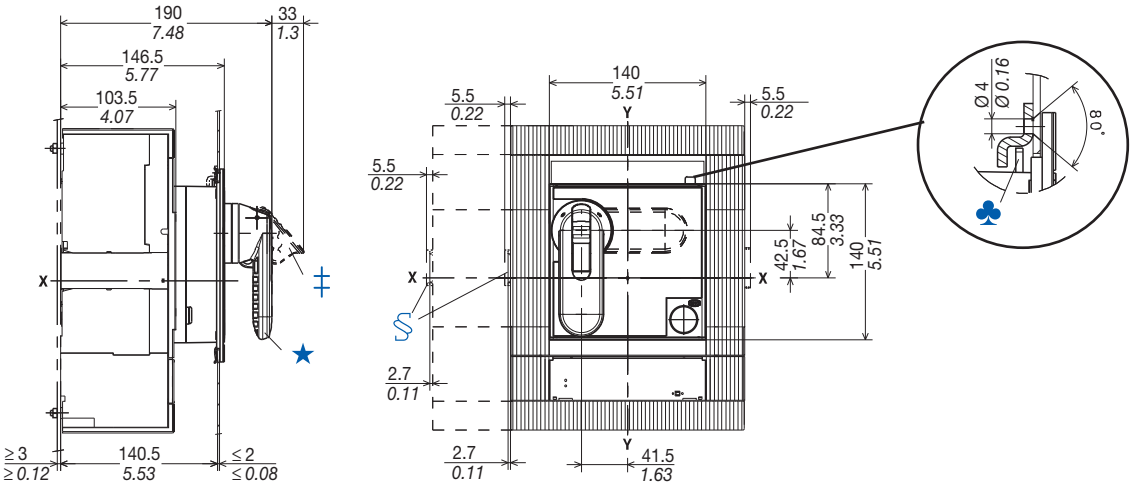
Cat. Nos. 140G-M-EXT3, -EXT4 Extended Terminals



Cat. Nos. 140G-M-EXSLI3, -EXSLO3, -EXS4 Spreader Terminals

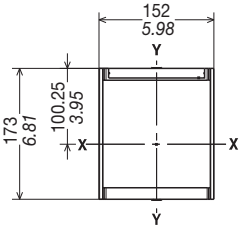


Cat. No. 140G-M-RMB, -RMY Rotary Handle Operating Mechanism — Door Mounted

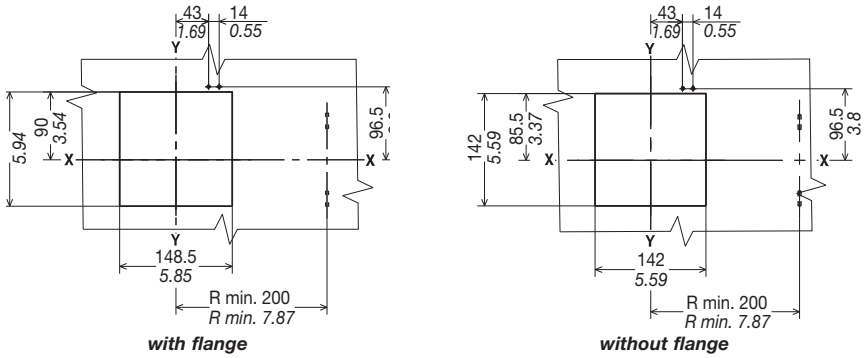


★ Rotary handle operating mechanism on molded case circuit breaker
‡ Padlock device for open position (max. 3 padlocks; user provided)
§ Dimension with cabled early make contact
♣ Compartment door lock

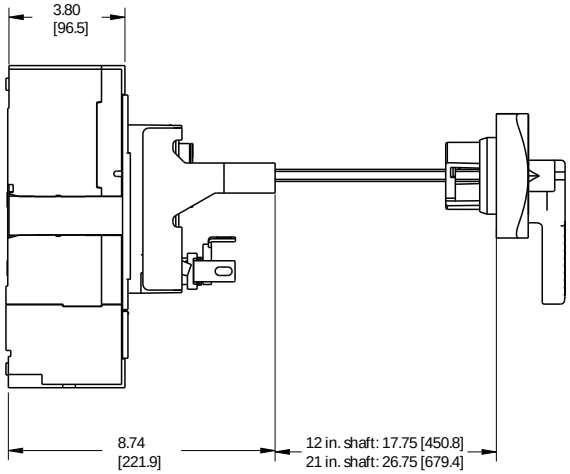
Flange for compartment door

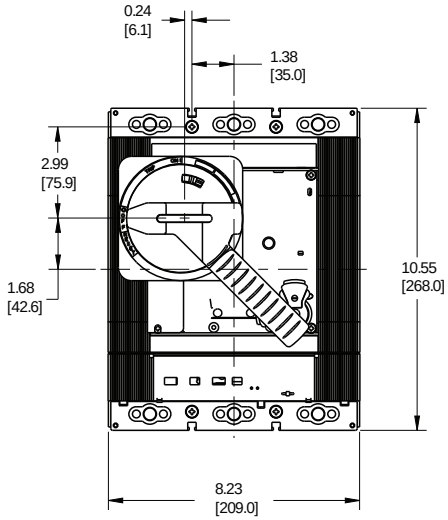


Drilling template for compartment door

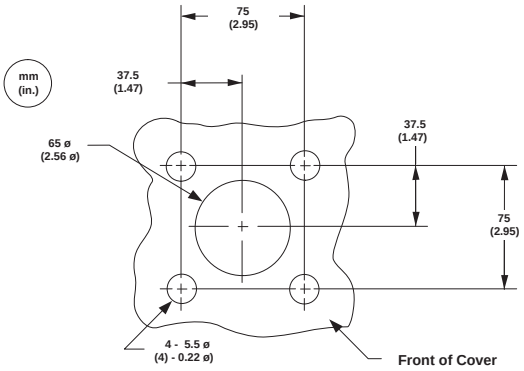


Cat. No. 140G-M-RVM... Variable Depth Rotary Handle Operating Mechanism

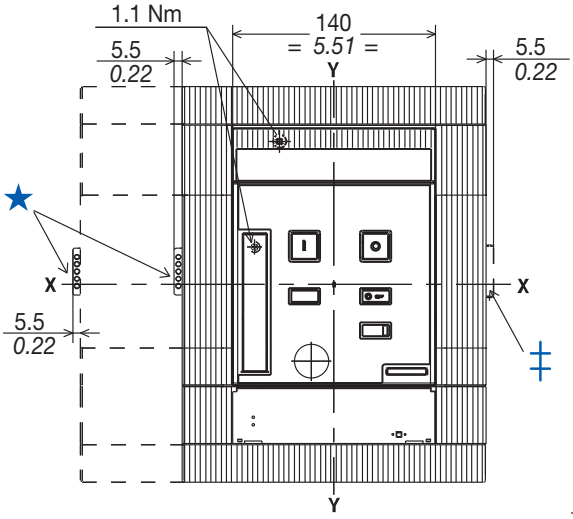


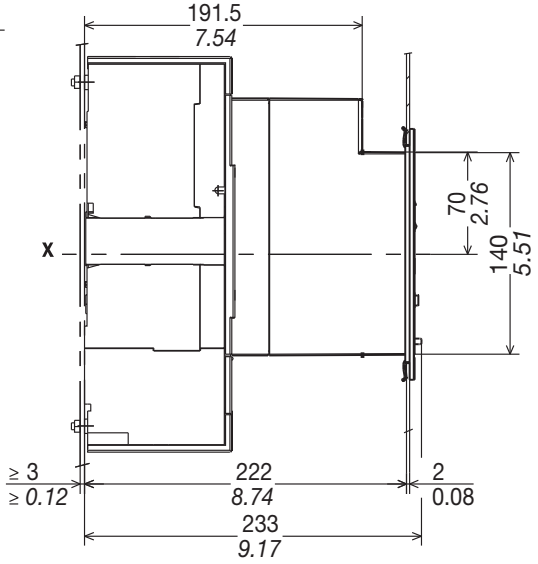


3-Pole



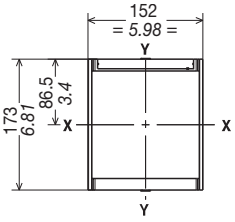
Cat. No. 140G-M-EOP, -ECOP Motor Operator



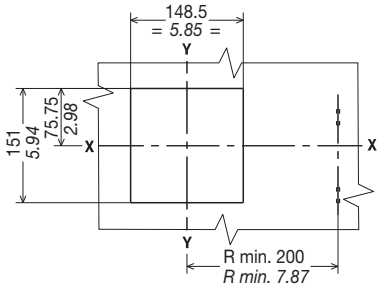


★ Overall dimension with cabled accessories mounted
‡ Overall dimension with cabled auxiliary contacts mounted

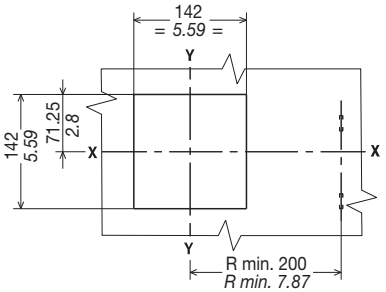
Flange for compartment door



Drilling template for compartment door

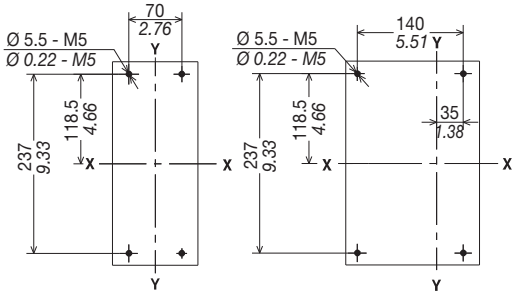


with flange



without flange

Drilling template for mounting plate



SECTION 6.9

RVSS CONTROL POWER TRANSFORMER

Lone Star Blower
8883 West Monroe
Houston, TX 77061

PH: 832-532-3112
FAX: 832-532-3115

1497-K-BASX-0-N

Transformers

				
Bulletin	1497	1497A	1497B	1497D
Type	**Control Circuit Transformer**	**Machine Tool Transformer**	**Control Power Transformer**	**General Purpose Transformer**
Features	• Single, dual, and multi-tap primary voltages • Single phase • EN 60-529 finger-safe protection • RoHS compliant • 50/60 Hz, 50 Hz, or 60 Hz • Optional Fusing	• Dual/Multi-tap • RoHS compliant • Single phase • 50/60 Hz • Optional Fusing	• Dual/Multi-tap • RoHS compliant • Single phase • 60 Hz only • Optional Fusing	• Indoor/outdoor non-ventilated enclosure • Single phase • Exceeds requirements of the Uniform Building Code (UBC) and California Code Title 24 • Copper windings provided for all transformers rated 2 kVA and below • Aluminum windings provided for all transformers rated 2 kVA and above • NEMA Type 3R rated enclosures • 50/60 HZ or 60 Hz
Output Power	63…2000VA	50…3000VA	50…3000VA	0.05…25 kVA
Input Voltage/ Primary Voltage	208…600V 220…550 (50 Hz)	208…575V (50/60 Hz)	120…600V	208…600V
Output Voltage/ Secondary Voltage	24…120V 24…230V (50 Hz)	24…120V (50/60 Hz)	24…240V	120…240V
Insulation	63…2000VA — Class 130 °C (55…80 °C temp. rise)	50…150VA — Class 105 °C (55 °C temp. rise) 200…1500VA — Class 130 °C (80 °C temp. rise) 2000…3000VA — Class 180 °C (100 °C temp. rise)		Class 180 °C (115 °C temp. rise)
Certifications	cULus, CE	cULus	cULus	UL, CSA
Standards	CSA C22.2 No. 66.1, EN 61558, UL 5085-1, 5085-2	CSA C22.2 No. 66.1, UL 5085-1, 5085-2	CSA C22.2 No. 66.1, UL 5085-1, 5085-2	CSA C22.2 No. 47 — M90, UL 1561
Product Selection	**Page 8-39**	**Page 8-46**	**Page 8-53**	**Page 8-59**

8

Cat. No. 1497-B-HXJX-3-N Control Circuit Transformer, 3-pole Fuse Block with Optional Cat. No. 1491-R150 Fuse Cover

Cat. No. 1497-C-BASX-0-N Control Circuit Transformer, Non-Fused

Bulletin 1497 — Global Control Circuit Transformers

Bulletin 1497 Global Control Circuit Transformers are designed to reduce supply voltages to control circuits. The complete line of transformers is available with optional factory-installed or panel-mount primary and secondary fuse block. A dual primary and secondary fuse block is pre-wired and mounted on top of the transformer up to 500VA.

- 63…2000VA
- Single, dual, and multi-tap primary voltages
- Single phase
- EN 60-529 finger-safe protection
- RoHS compliant

Table of Contents

Standards Compliance

UL 5085-1, UL 5085-2

EN61558

CSA C22.2 No. 66.1

Certifications

cULus Listed (File No. E52057; Guide No. XPTQ, XPTQ7)
CE

Catalog Number Explanation

Bulletin 1497 Multi-Tap Transformers

1497 – A – M1 – 3 – N
a b c d

a

VA Rating	
Code	Description [VA]
A	63
B	80
C	130
D	200
E	250
F	350
G	500
H	750
J	800
K	1000
L	1600
M	2000

b

Primary and Secondary Voltage		
Code	Primary	Secondary
M1	240V, 208V	120V (60 Hz)
M2	240V, 208V	24V (60 Hz)
M3	240V, 208V	24V, 120V (60 Hz)
M4	415V, 400V, 380V	115X230V (50 Hz)
M5	415V, 400V, 380V	24V (50 Hz)

c

Fuse Block Options§	
Code	Block Options
0	0 Primary, 0 Secondary
1	0 Primary, 1 Secondary
2	2 Primary, 0 Secondary
3	2 Primary, 1 Secondary

d

Factory Installed Options	
Code	Description
N	No Fusing, No Cover

Bulletin 1497 Transformers

1497 – A – BADX – 3 – N
a b c d

1497-K-BASX-0-N

a

VA Rating	
Code	Description [VA]
A	63
B	80
C	130
D	200
E	250
F	350
G	500
H	750
J	800
K	1000
L	1600
M	2000

b

Primary and Secondary Voltage		
Code	Primary	Secondary
HX	208V (60 Hz)	—
AX	240V (60 Hz), 220V (50 Hz)	—
BA∗	240X480V (60 Hz), 220X440V (50 Hz)	—
CX❄	600V (60 Hz), 550V (50 Hz)	—
DX‡	—	120V (60 Hz)
JX	—	24V (60 Hz)
SX	—	120V (60 Hz), 110V (50Hz)
JK	—	24V (50 Hz), 26V (60 Hz)

c

Fuse Block Options§	
Code	Block Options
0	0 Primary, 0 Secondary
1	0 Primary, 1 Secondary
2	2 Primary, 0 Secondary
3	2 Primary, 1 Secondary

d

Factory Installed Options	
Code	Description
N	No Fusing, No Cover

∗ When the primary voltage code **BA** is selected and a 120V AC secondary is desired, the secondary voltage code **SX** should be selected.
❄ VA rating codes **G**, **H**, or **J** with primary voltage over 500V have only cULus approval.
‡ Not available for use with primary voltage code **BA**.
§ VA rating codes **H**…**M** are only available with no fuse block option (**0**).

Selecting a Control Circuit Transformer

For proper transformer selection, three characteristics of the load circuit must be determined in addition to the minimum voltage required to operate the circuit. These are total steady-state (sealed) VA, total inrush VA, and inrush load power factor.

- Total steady-state (sealed) VA is the volt-amperes that the transformer must deliver to the load circuit for an extended period of time — the amount of current required to hold the contact in the circuit.
- Total inrush VA is the volt amperes that the transformer must deliver upon initial energization of the control circuit. Energization of electromagnetic devices takes 30…50 milliseconds. During this inrush period, the electromagnetic control devices draw many times normal current — 3…10 times normal is typical.
- Inrush load power factor is difficult to determine without detailed vector analysis of all the load components. Such an analysis is generally not feasible. Therefore, a safe assumption is 40% power factor.

Selection Process

1. Determine the total inrush VA of the control circuits from the table below. Do not neglect the current requirements of indicating lights and other devices that do not have an inrush VA but are re-energized at the same time as the other components in the circuit. Their total VA should be added to the total inrush VA.
2. Refer to the table below, *Regulation Data — Inrush VA*. If the supply circuit voltage (Step 1) is reasonably stable and fluctuates not more than ± 5%, refer to the 90% secondary voltage column. If it fluctuates as much as ± 10%, refer to the 95% secondary voltage column. Go down the column selected until at the inrush VA closest to, but not less than, the inrush VA of the control circuit.
3. Read to the far left side of the chart. The transformer's continuous nominal VA rating is now selected. The secondary voltage that will be delivered under inrush conditions will be either 85%, 90%, or 95% of the rated secondary voltage, depending on the column selected from the table below, *Regulation Data — Inrush VA*. The total sealed VA of the control circuit must not exceed the nominal VA rating of the transformer selected from the table below, *Typical Magnetic Motor Starter and Contactor Data 60 Hz, 120 Volt, 3-Pole*.
4. Refer to the specification tables on the following pages to select a transformer according to the required continuous nominal VA, and primary and secondary voltage combinations.

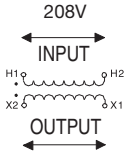
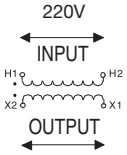
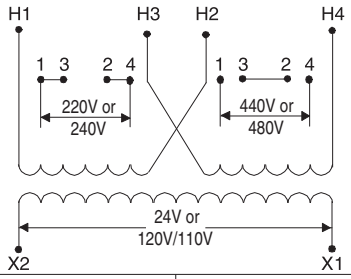
Regulation Data — Inrush VA

Inrush VA at 40% Power Factor				Power Factor Adjustments	
Nominal VA Rating	85%	90%	95%	Power Factor	Multiply By
63	347	289	216	100%	0.64
80	338	290	229	90%	0.67
130	907	745	541	80%	0.71
200	1267	1039	754	70%	0.78
250	1394	1116	781	60%	0.82
350	2870	2298	1584	50%	0.91
500	3786	3013	2065	40%	1.00
750	7360	5763	3786	30%	1.11
800	7360	5763	3786	20%	1.29
1000	8837	6785	4329	10%	1.50
1600	14921	11328	7070	—	—
2000	20500	14850	9100	—	—

Typical Magnetic Motor Starter and Contactor Data 60 Hz, 120 Volt, 3-Pole

	NEMA Size						
Contactor	0	1	2	3	4	5	
Bulletin 500	192	192	240	660	1225	1490	VA Inrush
	29	29	29	45	69	96	VA Sealed

Note: Refer to page 8-40 for information on how to select a control circuit transformer.

	Cat. Nos.					
	Primary 208V (60 Hz)  24V or 120V		Primary 240V (60 Hz)/220V (50 Hz)  24V or 120V/110V		Primary 240X480V (60 Hz) or 220X440V (50 Hz)  	
Continuous VA	Secondary 24V (60 Hz)	Secondary 120V (60 Hz)	Secondary 26V (60 Hz)/ 24V (50 Hz)	Secondary 120V (60 Hz)/ 110V (50 Hz)	Secondary 26V (60 Hz) or 24V (50 Hz)	Secondary 120V (60 Hz) or 110V (50 Hz)
63	**1497-A-HXJX-0-N**	1497-A-HXDX-0-N	1497-A-AXJK-0-N	1497-A-AXSX-0-N	**1497-A-BAJK-0-N**	**1497-A-BASX-0-N**
80	**1497-B-HXJX-0-N**	1497-B-HXDX-0-N	1497-B-AXJK-0-N	1497-B-AXSX-0-N	**1497-B-BAJK-0-N**	**1497-B-BASX-0-N**
130	1497-C-HXJX-0-N	1497-C-HXDX-0-N	1497-C-AXJK-0-N	**1497-C-AXSX-0-N**	**1497-C-BAJK-0-N**	**1497-C-BASX-0-N**
200	**1497-D-HXJX-0-N**	1497-D-HXDX-0-N	1497-D-AXJK-0-N	1497-D-AXSX-0-N	1497-D-BAJK-0-N	**1497-D-BASX-0-N**
250	1497-E-HXJX-0-N	1497-E-HXDX-0-N	1497-E-AXJK-0-N	1497-E-AXSX-0-N	**1497-E-BAJK-0-N**	**1497-E-BASX-0-N**
350	**1497-F-HXJX-0-N**	**1497-F-HXDX-0-N**	1497-F-AXJK-0-N	**1497-F-AXSX-0-N**	1497-F-BAJK-0-N	**1497-F-BASX-0-N**
500	1497-G-HXJX-0-N	1497-G-HXDX-0-N	1497-G-AXJK-0-N	1497-G-AXSX-0-N	1497-G-BAJK-0-N	**1497-G-BASX-0-N**
750	1497-H-HXJX-0-N	**1497-H-HXDX-0-N**	1497-H-AXJK-0-N	1497-H-AXSX-0-N	1497-H-BAJK-0-N	**1497-H-BASX-0-N**
800	1497-J-HXJX-0-N	1497-J-HXDX-0-N	1497-J-AXJK-0-N	1497-J-AXSX-0-N	1497-J-BAJK-0-N	**1497-J-BASX-0-N**
1000	1497-K-HXJX-0-N	**1497-K-HXDX-0-N**	1497-K-AXJK-0-N	1497-K-AXSX-0-N	1497-K-BAJK-0-N	**1497-K-BASX-0-N**
1600	—	1497-L-HXDX-0-N	—	1497-L-AXSX-0-N	—	**1497-L-BASX-0-N**
2000	—	1497-M-HXDX-0-N	—	**1497-M-AXSX-0-N**	—	**1497-M-BASX-0-N**
With 2-Pole Primary and 1-Pole Secondary Top-Mounted Fuse Block ♣ — Fuses Not Included						
63	1497-A-HXJX-3-N	**1497-A-HXDX-3-N**	1497-A-AXJK-3-N	**1497-A-AXSX-3-N**	**1497-A-BAJK-3-N**	**1497-A-BASX-3-N**
80	1497-B-HXJX-3-N	**1497-B-HXDX-3-N**	1497-B-AXJK-3-N	1497-B-AXSX-3-N	**1497-B-BAJK-3-N**	**1497-B-BASX-3-N**
130	1497-C-HXJX-3-N	**1497-C-HXDX-3-N**	1497-C-AXJK-3-N	1497-C-AXSX-3-N	1497-C-BAJK-3-N	**1497-C-BASX-3-N**
200	1497-D-HXJX-3-N	**1497-D-HXDX-3-N**	**1497-D-AXJK-3-N**	1497-D-AXSX-3-N	**1497-D-BAJK-3-N**	**1497-D-BASX-3-N**
250	1497-E-HXJX-3-N	1497-E-HXDX-3-N	1497-E-AXJK-3-N	1497-E-AXSX-3-N	1497-E-BAJK-3-N	**1497-E-BASX-3-N**
350	1497-F-HXJX-3-N	**1497-F-HXDX-3-N**	1497-F-AXJK-3-N	**1497-F-AXSX-3-N**	1497-F-BAJK-3-N	**1497-F-BASX-3-N**
500	1497-G-HXJX-3-N	**1497-G-HXDX-3-N**	1497-G-AXJK-3-N	1497-G-AXSX-3-N	1497-G-BAJK-3-N	**1497-G-BASX-3-N**

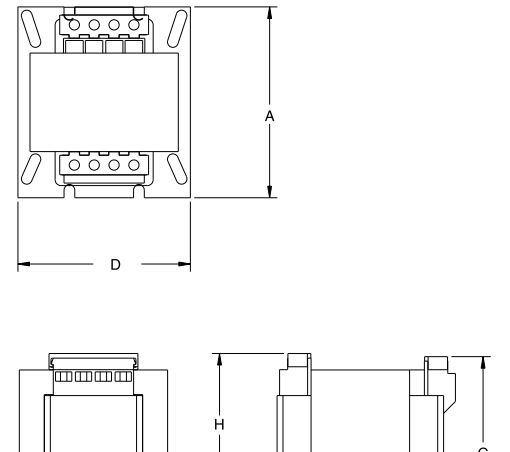
♣ Top-mounted fuse blocks are not available for transformers 750VA and higher.

8

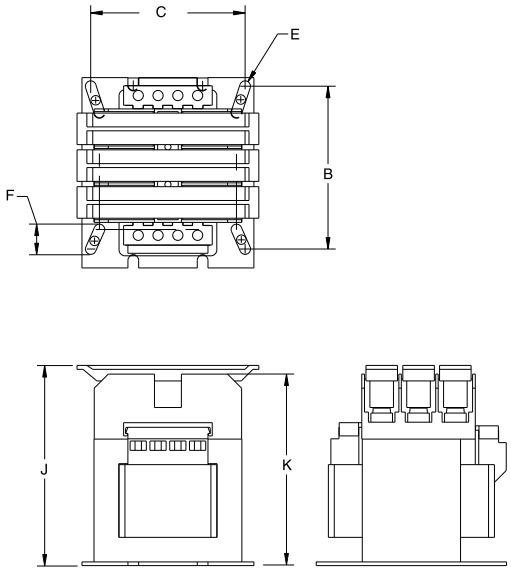
Control Circuit Transformers

Approximate Dimensions

Dimensions are shown in inches (millimeters). Dimensions are not intended to be used for manufacturing purposes.

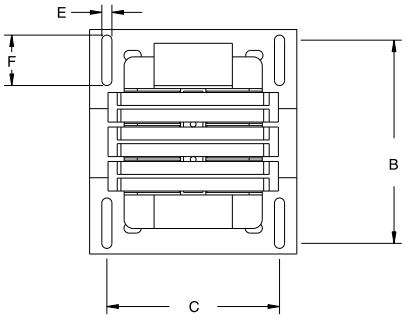


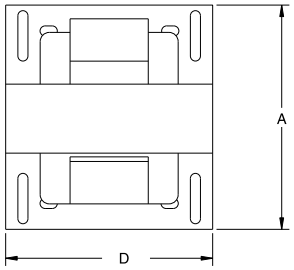
Transformer without Fusing

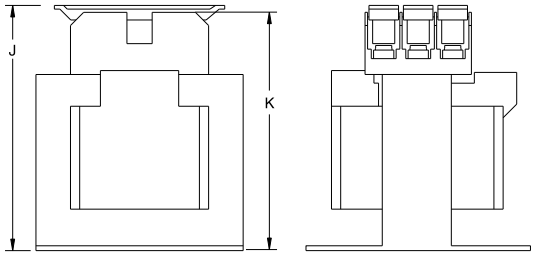


Transformer with Fuse Holder and Covers

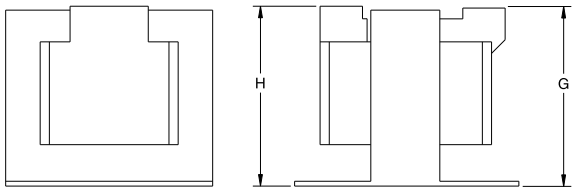
VA	A	B	C	D	E	F	G	H	J	K	Approximate Shipping Wt. — lb (kg)	
											Without Top-Mounted Fuse Block	2-Pole Primary and 1-Pole Secondary Top-Mounted Fuse Block
63	3-7/8 (98.00)	3-1/4 (82.55)	3-1/8 (79.38)	3-1/2 (88.90)	7/32 (5.54)	22/32 (18.29)	2-27/32 (72.39)	2-3/8 (73.91)	4-5/64 (103.51)	3-57/64 (99.01)	4-1/2 (2.04)	4-4/5 (2.18)
80	3-7/8 (98.00)	3-1/4 (82.55)	3-1/8 (79.38)	3-1/2 (88.90)	7/32 (5.54)	22/32 (18.29)	2-27/32 (72.39)	2-3/8 (73.91)	4-5/64 (103.51)	3-57/64 (99.01)	4-1/2 (2.04)	4-4/5 (2.18)
130	3-7/8 (98.00)	3-1/4 (82.55)	3-1/8 (79.38)	3-1/2 (88.90)	7/32 (5.54)	22/32 (18.29)	3-3/8 (85.60)	3-13/32 (86.61)	4-45/64 (119.5)	4-35/64 (115.44)	6-7/10 (3.04)	7-3/20 (3.24)







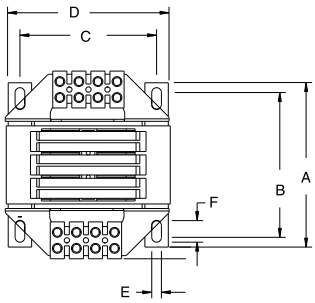
Transformer with Fuse Holder and Covers

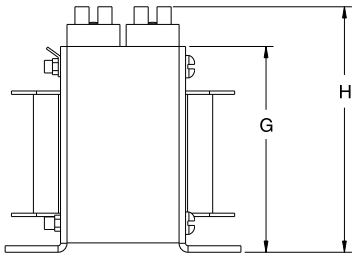


Transformer without Fusing

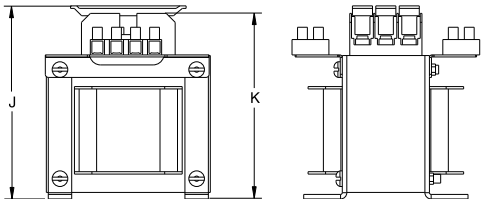
VA	A	B	C	D	E	F	G	H	J	K	Approximate Shipping Wt. — lb (kg)	
											Without Top-Mounted Fuse Block	2-Pole Primary and 1-Pole Secondary Top-Mounted Fuse Block
200	4-7/8 (123.95)	4-7/16 (112.78)	3-3/4 (95.25)	4-1/2 (114.30)	7/32 (5.59)	1-1/8 (28.70)	3-3/8 (85.60)	3-29/32 (86.61)	5-21/64 (135.26)	5-11/64 (131.44)	8-2/5 (3.81)	8-7/10 (3.95)
250	4-7/8 (123.95)	4-7/16 (108.20)	3-3/4 (95.25)	4-1/2 (114.30)	7/32 (5.59)	1-1/8 (28.70)	3-7/8 (98.30)	3-29/32 (98.30)	5-21/64 (135.26)	5-11/64 (131.44)	10-2/5 (4.72)	10-4/5 (4.90)
350	4-7/8 (123.95)	4-7/16 (108.20)	3-3/4 (95.25)	4-1/2 (114.30)	7/32 (5.59)	1-1/8 (28.70)	3-7/8 (98.30)	3-29/32 (98.30)	5-21/64 (135.26)	5-11/64 (131.44)	13-2/5 (6.08)	13-4/5 (6.26)

Dimensions are shown in inches (millimeters). Dimensions are not intended to be used for manufacturing purposes.



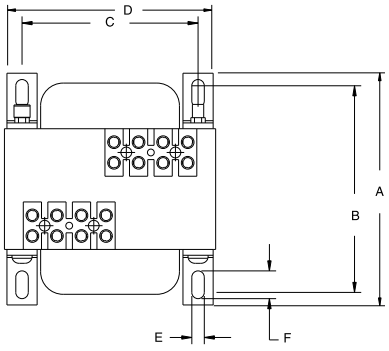


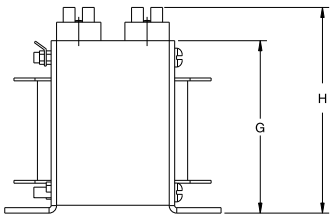
Transformer without Fusing

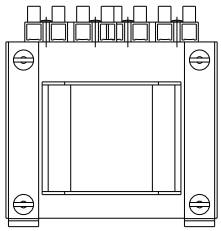


Transformer with Fuse Holder and Covers

VA	A	B	C	D	E	F	G	H	J	K	Approximate Shipping Wt. — lb (kg)	
											Without Top-Mounted Fuse Block	2-Pole Primary and 1-Pole Secondary Top-Mounted Fuse Block
500	5-1/4 (133.35)	4-33/64 (114.81)	4-3/8 (111.25)	5-1/4 (133.35)	5/16 (7.87)	45/64 (18.03)	4-17/32 (114.81)	5-1/2 (139.70)	6-3/16 (156.97)	5-15/16 (150.62)	17-3/5 (7.98)	17-19/20 (8.14)







Transformer without Fusing

VA	A	B	C	D	E	F	G	H	Approximate Shipping Wt. — lb (kg)
									Without Top-Mounted Fuse Block
750	5-3/4 (146.05)	5 (127.51)	4-3/8 (111.25)	5-1/4 (133.35)	5/16 (7.87)	45/64 (18.03)	4-9/16 (114.81)	5-19/32 (137.41)	21-1/2 (9.75)
800	5-3/4 (146.05)	5 (127.51)	4-3/8 (111.25)	5-1/4 (133.35)	5/16 (7.87)	45/64 (18.03)	4-9/16 (114.81)	5-19/32 (137.41)	21-1/2 (9.75)
1000	6-3/8 (161.92)	5-3/8 (136.53)	5-5/16 (134.94)	6-3/8 (161.92)	5/16 (7.87)	45/64 (18.03)	5-33/64 (140.21)	6-1/2 (162.56)	37-1/5 (16.87)
1600	8-1/2 (215.90)	7-1/4 (184.15)	5-3/4 (143.76)	6-3/4 (171.45)	7/16 (10.92)	45/64 (18.03)	5-3/4 (146.05)	7-1/16 (168.66)	50-4/5 (23.04)
2000	9-1/2 (241.30)	8-1/4 (209.55)	5-3/4 (143.76)	6-3/4 (171.45)	7/16 (10.92)	45/64 (18.03)	5-11/64 (149.86)	7-1/16 (172.47)	61 (27.67)

SECTION 6.10

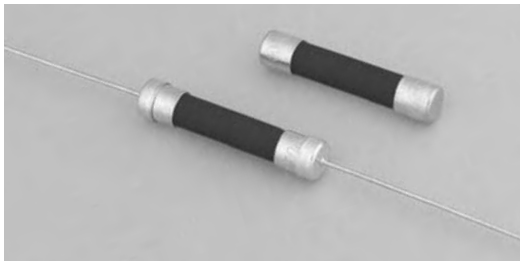
RVSS FUSES

Lone Star Blower
8883 West Monroe
Houston, TX 77061

PH: 832-532-3112
FAX: 832-532-3115

MDA

1/4" x 1 1/4" Time-delay ceramic tube fuses



Product features

- Time-delay
- Optional axial leads available
- 1/4" x 1-1/4" (6.35 x 31.75 mm) physical size
- Ceramic tube, nickel-plated brass endcap construction
- UL Listed product meets standard 248-14

Agency information

- UL Listed Card: MDA 1/4 - 20 A (Guide JDYX, File E19180)
- UL Recognized Card: MDA 25 - 30 A (Guide JDYX2, File E19180)
- CSA Certification Card: MDA 1/4 - 20 A (Class No. 1422-01)
- CSA Component Acceptance: MDA 25 - 30 A (Class No. 1422-30)

General specifications

- Shock: 1 A thru 30 A – MIL-STD-202, Method 213, Test Condition J
- Vibration: 1/4 A thru 30 A – MIL-STD-202, Method 204, Test Condition C (Except 5 g, 500 Hz)

Ordering

- Specify packaging code prefix, part number and and option code. Replace the "/" with a "-" (i.e. BK-MDA-BV-1-4-R)

Electrical characteristics		
Rated current	Amp rating	Opening time
1/4 - 30 A	100%	None
	135%	60 minutes max.
	200%	120 seconds max.

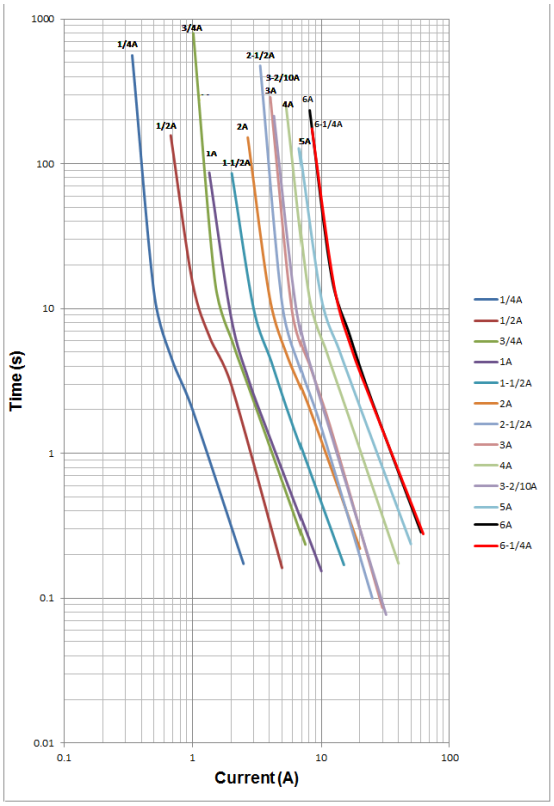
Specifications

Part number	Voltage rating		AC interrupting rating* (A)		DC interrupting rating (A) 125 V	Typical DC cold resistance** (Ω)	Typical melting I^2t† AC	Typical voltage drop‡
	Vac	Vdc	250 V	125 V				
MDA-1/4-R	250	-	35	10000	-	8.7	0.748	4.00
MDA-1/2-R	250	-	35	10000	-	1.78	2.53	1.42
MDA-3/4-R	250	-	35	10000	-	0.82	8.58	1.31
MDA-1-R	250	-	35	10000	-	0.56	12.21	1.03
MDA-1-1/2-R	250	-	100	10000	-	0.2565	27.5	0.691
MDA-2-R	250	-	100	10000	-	0.17	70.4	0.623
MDA-2-1/2-R	250	125	200	10000	10000	0.068	31.79	0.213
MDA-3-R	250	125	200	10000	10000	0.0525	44.99	0.182
MDA-4-R	250	125	200	10000	10000	0.03575	147.4	0.162
MDA-5-R	250	125	200	10000	10000	0.0256	380.49	0.145
MDA-6-R	250	125	200	10000	10000	0.02035	587.73	0.141
MDA-7-R	250	125	200	10000	10000	0.0165	638.33	0.137
MDA-8-R	250	125	200	10000	10000	0.013	1038.4	0.134
MDA-10-R	250	125	200	10000	10000	0.00925	1620.43	0.135
MDA-12-R	250	125	750	10000	10000	0.00755	125.18	0.128
MDA-15-R	250	125	750	10000	10000	0.00565	336.82	0.107
MDA-20-R	250	125	1500	10000	10000	0.004065	483.45	0.095
MDA-25-R	250	125	1500	10000	10000	0.0031	734.69	0.105
MDA-30-R	250	125	1500	10000	10000	0.002465	1096.7	0.110

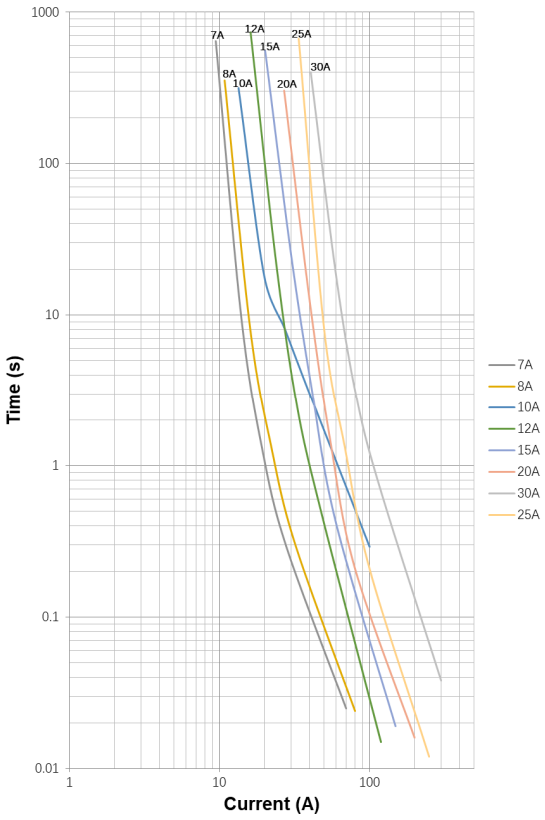
* Interrupting ratings (Measured at 70% - 80% power factor on AC. The interrupting ratings for 25 A, 30 A were measured at 90% - 100% power factor on AC)
** DC Cold resistance (Measured at _<10% of rated current)
† Typical melting I^2t (A^2sec) (I^2t was measured at listed interrupting rating and rated voltage)
‡ Typical voltage drop (Voltage drop was measured at +25 °C ambient temperature at rated current)

MDA
1/4" x 1 1/4" Time-delay ceramic tube fuses

Time-current curves (1/4 A - 6 1/4 A)

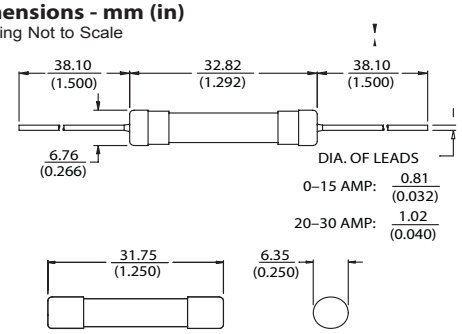


Time-current curves (7 A - 30 A)



Dimensions - mm (in)

Drawing Not to Scale



Packaging code	
Packaging code prefix	Description
BK-	100 fuses packed into a cardboard carton

Option code	
Option code	Description
B	Sealed to withstand aqueous cleaning (Board washable)
V	Axial leads - copper tinned wire with nickel plated brass overcaps

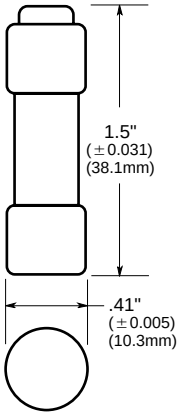
Eaton
Electronics Division
1000 Eaton Boulevard
Cleveland, OH 44122
United States
Eaton.com/electronics

Powering Business Worldwide

CC-TRON®
Time-Delay Fuses
13/32″ × 1½″, 600 Volt, ¼ to 30 Amps

FNQ-R

Dimensional Data



Catalog Symbol: FNQ-R
Time-Delay
Application: Circuit Transformer Protection
Ampere Rating: ¼ to 30A
Voltage Rating: 600Vac (or less)†
Interrupting Rating: 200,000A RMS Sym. (UL)
Agency Information:
UL Listed, Std. 248-4, Class CC, Guide JDDZ, File E4273
CSA Certified, Class CC CSA, Class 1422-01,
File 53787–HRC-MISC

†12-30A is 300Vdc and 10k AIR.

General Information:

- The Bussmann CC-TRON® (FNQ-R) was designed to meet the needs of control circuit transformer protection.
- Current-limitation protects down stream components against damaging thermal and magnetic effects of short-circuit currents.
- **High inrush time-delay.** Control circuit transformers can experience inrush currents up to 85 times their full-load current rating. FNQ-R fuses can be sized according to NEC and UL requirements and still allow the high inrush currents, with significantly more time-delay than the UL minimum value of 12 seconds at 200% for Class CC fuses.
- Melamine tube. Nickel-plated brass endcaps.

Maximum Acceptable Rating of Overcurrent Device*

Rated Primary Current (Amperes)	Maximum Rating of Overcurrent Protective Device Expressed As A Percent of Transformer Primary Current Rating
Less than 2A	500**
2A to less than 9A	167
9A or more	125

*UL 508A Table 42.1.
**300% for other than motor control applications.

CE logo denotes compliance with European Union Low Voltage Directive (50-1000Vac, 75-1500Vdc). Refer to Data Sheet: 8002 or contact Bussmann Application Engineering at 636-527-1270 for more information.

Electrical Ratings (Catalog Symbol and Amperes)

FNQ-R-¼	FNQ-R-1 3/10	FNQ-R-3 2/10	FNQ-R-8
FNQ-R-3/10	FNQ-R-1 1/10	FNQ-R-3½	FNQ-R-9
FNQ-R-4/10	FNQ-R-1½	FNQ-R-4	FNQ-R-10
FNQ-R-½	FNQ-R-1 6/10	FNQ-R-4½	FNQ-R-12
FNQ-R-6/10	FNQ-R-1 8/10	FNQ-R-5	FNQ-R-15
FNQ-R-¾	FNQ-R-2	FNQ-R-5 6/10	FNQ-R-17½
FNQ-R-8/10	FNQ-R-2¼	FNQ-R-6	FNQ-R-20
FNQ-R-1	FNQ-R-2½	FNQ-R-6¼	FNQ-R-25
FNQ-R-1⅛	FNQ-R-2 8/10	FNQ-R-7	FNQ-R-30
FNQ-R-1¼	FNQ-R-3	FNQ-R-7½	—

Carton Quantity and Weight

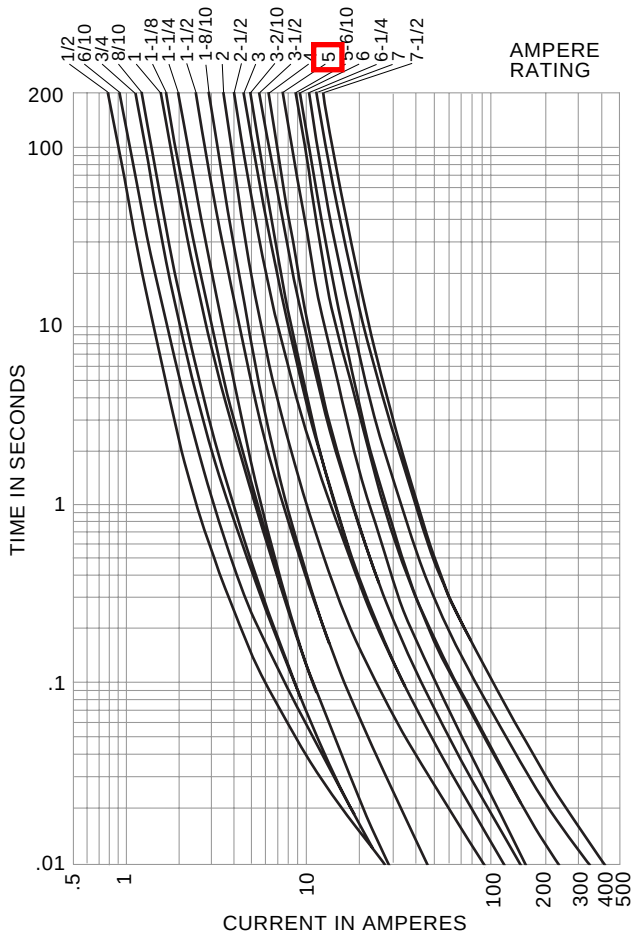
Ampere Ratings	Carton Qty.	Weight*	
		Lbs.	Kg.
¼-30	10	.200	.091

*Weight per carton

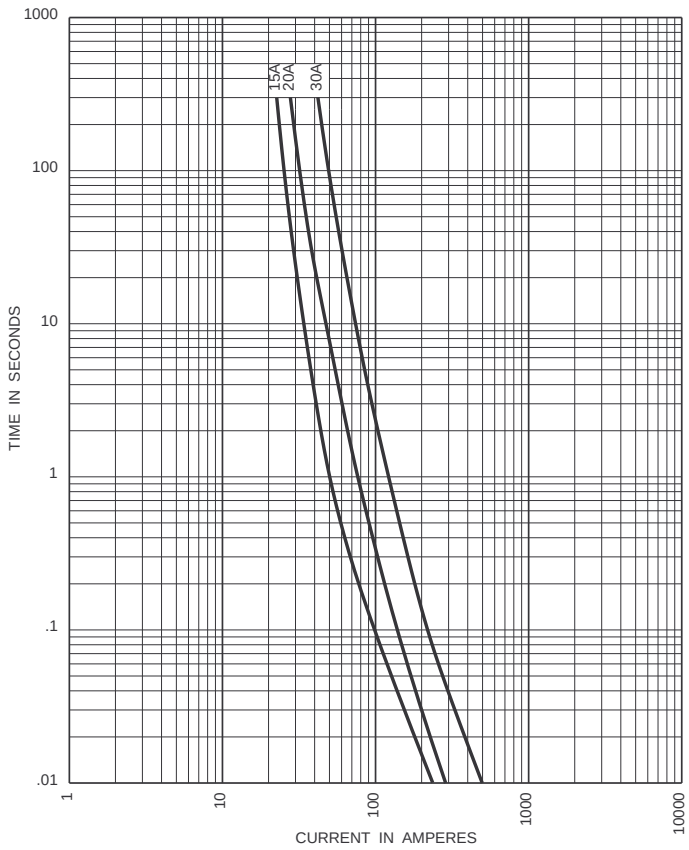
CC-TRON®
Time-Delay Fuses
13/32″ × 1½″, 600 Volt, ¼ to 30 Amps

FNQ-R

Time-Current Characteristics–Average Melt



Time-Current Characteristics–Average Melt



Recommended fuseblocks/fuseholders for Class CC 600V fuses

See Data Sheets listed below

- Open fuseblocks - 1105
- Finger-safe fuseholders - 1109, 1102, 1103, 1151
- Panel-mount fuseholders - 2114, 2113
- In-line fuseholders - 2126

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