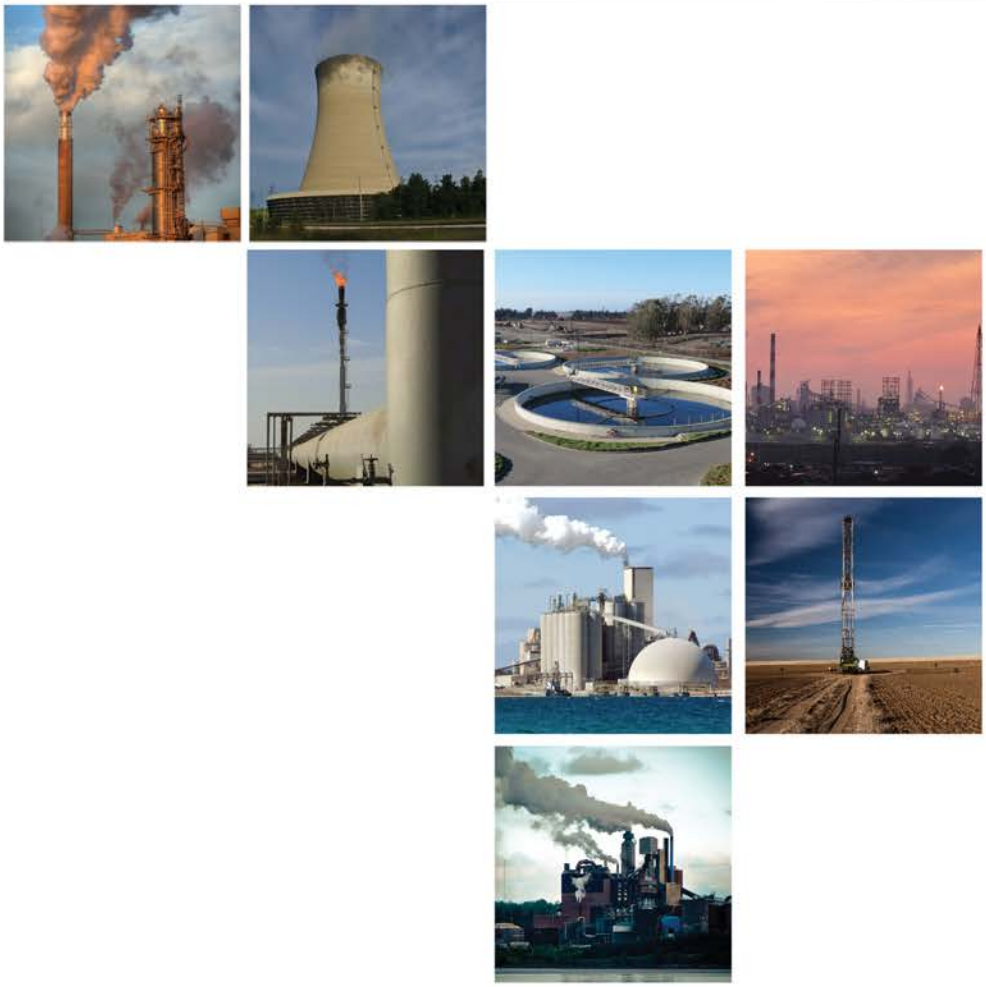
Technical Reference

KURZ INSTRUMENTS INC.™

Tel: 800.424-7356
www.KurzInstruments.com

Series 255 Flow Averaging Transmitter Hardware Guide



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Kurz Instruments Inc.
2411 Garden Road
Monterey, CA 93940
831-646-5911 (main)
831-646-8901 (fax)

Kurz Device Support
Customer Service
800-424-7356 (toll free)
www.kurzinstruments.com
service@kurzinstruments.com

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Preface

Before You Begin

Important ***The device warranty is void if it is not installed in accordance with the installation requirements specified in this guide. Read and thoroughly understand the installation requirements before attempting to install the device. If you have any questions, contact your Kurz customer service representative before attempting installation.***

Using this Manual

Kurz Instruments, Inc., documentation includes manuals and product literature, Adobe Acrobat PDF files, and application online Help files. The Kurz Instruments CD contains all the available documentation files. To read PDF files, download the free Adobe Acrobat Reader from www.adobe.com.

The Kurz Instruments website provides additional information:

- **World Wide Web:** www.KurzInstruments.com
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- Documentation links to the most current manuals and literature

You can access device support in the following ways:

- **Main:** 831-646-5911
- **Phone:** 800-424-7356
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Manual Conventions

The following table lists conventions used in the Kurz documentation and provides an example or description of each convention.

Table 1. Conventions used in this manual

Convention / Example	Description
Check the **Configuration File** checkbox	Text that you type, click, or select (for example, field names, menus, and commands) appear in bold.
`PRESS ENTER TO` `SET METER DATA`	Text appearing in a display or window is shown in courier.
Select **Start→All Programs→Kurz Instruments→KzComm**	An arrow (→) is used to separate a menu name from its submenu commands.
Programs Files\Kurz Instruments\KzComm	Simplified directory structures and path names are used in examples. Your folder names may be different.
Note Information....	Indicates additional information to clarify a procedure, action, event, or concept and ensure appropriate understanding.
Important ***Information....***	Indicates information relevant to proper operation, actions, and responses.
Caution ***Information....***	Indicates an action or procedure can result in incorrect operation or destruction of the device if not performed properly. Comply strictly with the instructions.
Warning ***Information....***	Indicates an action or procedure can result in injury or a safety hazard if not performed properly. Comply strictly with the instructions and proceed with care.
	**Protective ground connection** A terminal that must be connected to ground prior to establishing any other connections
	**High Voltage** Indicates the presence of an electrocution hazard.

Glossary

Alarms

There are two alarms on the Series 255 that are each linked to an optically coupled solid state relay (SSR). The relays can be used to interface with external warning lamps or audible devices when an alarm event occurs.

Note The relays are optically isolated solid-state relays (SPST switching), their non-powered state is an open circuit and must be considered for fail-safe alarm logic configurations.

The alarm relays are rated for 0.5 A

Channel

Refers to one of the flow meters or flow sensing units that the Series 255 provides power to and communicates with to obtain velocity, temperature, and status data. There are up to 16 channels assigned letters A through P. Each flow meter or channel is assigned a unique and fixed address starting at address 11 through 26.

Kurz multipoint Kflow meters have two to four flow sensing units
Kurz single-point flow meters one flow sensing unit.

Channel Kickout

This specifies when a defective flow meter is removed from the flow and temperature average calculations.

Daily Totalization

The Series 255 accumulates a total flow for each day. The daily total begins accumulating at midnight each day. Thirty-five days of daily totalization is recorded in the EEPROM and can be downloaded to a text file.

Factory configuration

Default parameter values of the device, usually based on customer order specifications.

Flow Meter / Flow Sensor

The individual sensing device also referred to as a channel.

Flow units

The flow units determine whether the Series 255 system engineering units are metric or imperial measurements and the units that appear for velocity and temperature. The flow units can be flow rate or mass rate. The flow rate options are NCMH, NLPM, SCFH, SCFM, SCMH, and SLMP. The mass rate options are KGH, KGM, PPH, and PPM.

Haz Loc

Hazardous (and potentially hazardous) Location environment due to the presence or possible presence of flammable gases and vapors, and combustible dusts.

NE-43

NAMUR NE-43 is a German fault detection standard that lets the user know if there is a fault within the instrument by forcing the 4-20 mA output current outside the normal operating range of the instrument.

Output	There are two 4-20 mA analog outputs on the Series 255. Each is user assignable to flow rate, velocity, or temperature, and user scalable to represent the full range or any subset. They are isolated and have fault indication per NAMUR NE-43 guidelines.
Ord Loc	Ordinary Industrial Location environments where rough usage, moisture, dust, dirt, and corrosion are a potential problem and where there is no presence of flammable gases or combustible dusts.
Port	The Series 255 main board has six ports that each provide an isolated RS-485 and 24 VDC to individual channels or channel groups.
RTC	The real-time clock provides a time stamp of date and time for events logged to the event log in the Series 255 non-volatile memory.
Totalizer	The Series 255 keeps a running accumulation of the total flow. There are two records of total flow that the Series 255 maintains – one that is not resettable and one that can be reset by the user.

Chapter 1

Introduction

Overview

The Kurz Series 255 Flow Averaging Transmitter is designed for gas flow measurements in ducts or stacks where two or more sensing points are required due to a large duct size or where irregular flow profiles are present. The Series 255 is a microprocessor-based flow transmitter that continuously collects process flow and temperature measurements from multiple independent Kurz flow meters and calculates a grand average of the flow and temperature in the duct.

The Series 255 works in conjunction with two or more Kurz Instruments B-Series flow meters – either the Kurz 454FTB, K-BAR 2000B, or K-BAR 2000B-WGF insertion meters. The four models in the Series 255 product line support up to 4, 9, or 16 flow sensors for performing the following functions:

- Provide 24 VDC power to each flow sensor.
- Flow and temperature averaging.
- Kickout from the average any channels in error or being serviced.
- Provide 4-20 mA analog output signal of the averaged flow and temperature.
- Flow totalization – both resettable and non-resettable 30-day log of daily flow totals.

Refer to Appendix A, “Drawings & Diagrams,” for specific technical data.

Pre-Installation

Kurz Instruments designs, manufactures, and tests its products to meet many national and international standards. Our products are sophisticated, technical devices that must be properly installed, used, and maintained to ensure continued operation within normal specifications. Failure to follow instructions can result in loss of life, personal injury, property damage, damage to the instrument, or warranty invalidation.

Important ***This document may include descriptions and equipment not used in your configuration. You should become thoroughly familiar with the operation of this device before operating it. Read this reference manual completely.***

The following instructions must be adhered to and integrated into your safety program when installing, using, and maintaining Kurz devices.

- Read all instructions prior to installing, operating, and servicing the device.
- If you do not understand any of the instructions, contact your Kurz representative for clarification.
- Follow all warnings, cautions, and instructions marked on and supplied with the device.
- Inform and educate your personnel in the proper installation, operation, and maintenance of the device.
- Install devices as specified in the installation instructions and follow applicable local and national codes. Connect all devices to the proper electrical sources.
- To ensure proper performance, use qualified personnel to install, operate, update, program, and maintain the device.
- This device contains components sensitive to electrostatic discharge (ESD), which can cause internal damage and affect normal operation. The following general ESD prevention measures should be considered:
  - Conductive or static-dissipative flooring in combination with wearing static dissipative footwear
  - Grounding for personnel including conductive wrist straps, footwear, gloves, clothing, or hairnets
  - Education and training on ESD prevention
- When replacement parts are required, ensure that qualified people use replacement parts specified by Kurz Instruments. Unauthorized parts and procedures can affect product performance, place the safe operation of your process at risk, and VOID YOUR WARRANTY. Unsuitable substitutions may result in fire, electrical hazards, or improper operation.
- Ensure that all enclosure doors are closed and protective covers are in place, except when maintenance is being performed by qualified personnel.

The purpose of this manual is to provide information concerning components, functions, installation, and maintenance of the Kurz Series 255 Flow Averaging Transmitter.

System Design

The system is made up of two components:

- A sensor array with two or more flow sensing units.
- The Series 255 flow transmitter, which collects and processes the sensor array data used for computing averaged flow and temperature outputs.

The sensor array is customized to measure the process velocity in equal area zones in the large duct. The flow sensing component of the Series 255 System is provided by Kurz Instruments B-Series product such as the K-BAR 2000B, K-BAR 2000B-WGF, 454FTB, and 454FTB-WGF. The Series 255 is designed to provide 24VDC power to the individual flow sensing units.

A typical system includes a Series 255 flow transmitter with one or more multipoint K-BARs. Figure 1-1 shows a typical installation in a stack monitoring application with two Kurz K-BAR 2000B 4-point flow meters and the Series 255B Flow Averaging Transmitter.

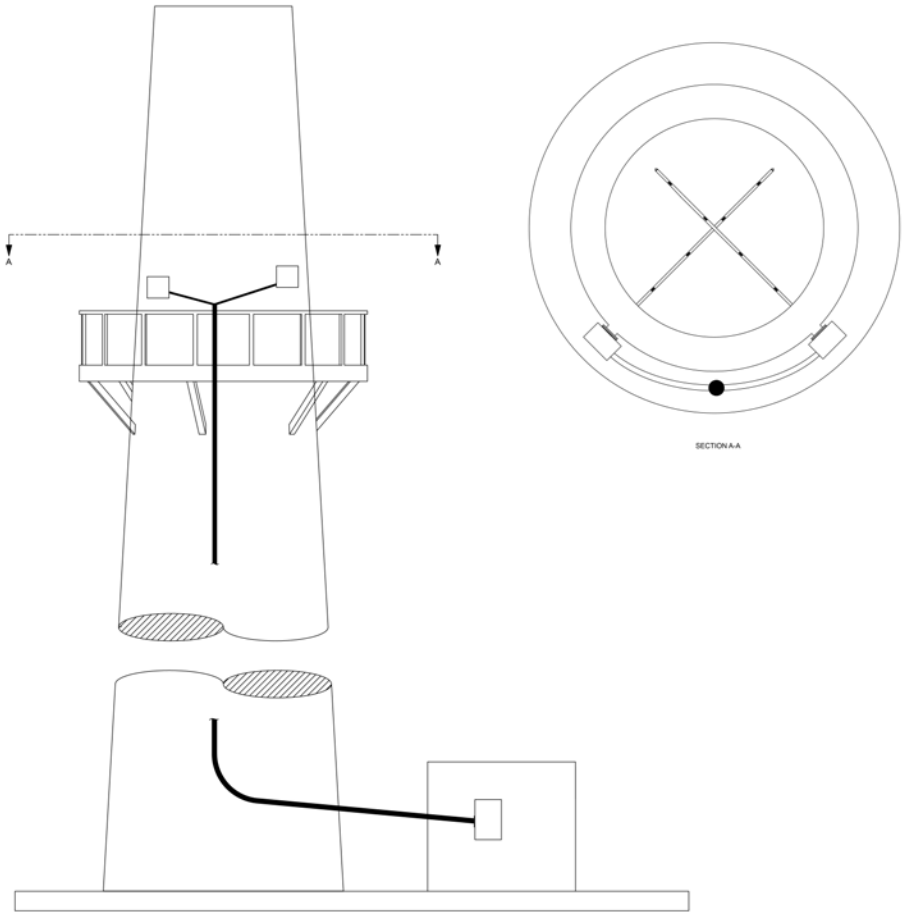


Figure 1-1. Typical stack installation

The Series 255 communicates with the individual flow sensing units over RS-485 using the Modbus RTU protocol and continuously requests velocity, temperature, and status data from each of the flow sensing units.

Each flow sensing unit has a unique address that the Series 255 uses to communicate with each flow meter on the network. The channel IDs and the corresponding Modbus addresses are preset in the Series 255 and cannot be changed. The channel IDs and Modbus addresses are listed in Table 1-1.

Table 1-1. Channel IDs and Modbus Addresses

Channel	Address
A	11
B	12
C	13
D	14
E	15
F	16
G	17
H	18

Channel	Address
I	19
J	20
K	21
L	22
M	23
N	24
O	25
P	26

The RS-485 interface is half-duplex and supports 9600, 14400, 19200, 38400, and 57600 baud rates. The Series 255 and the flow sensing channels are by default set up to communicate at 38400 bps. The measurement rate at this baud is approximately 0.1 seconds per channel; for example, the Series 255 is able to update process data every 0.5 seconds for a sensor array with four sensors. This communication rate is configurable and is dependent on the distance between the Series 255 and the flow sensing channels. A longer distance requires a slower baud rate.

The Series 255 requires the flow sensing units to provide velocity and temperature data in metric units. The Series 255 checks this on power-up of the system and when an individual flow meter is put online. If the flow meter is not configured for metric units, the Series 255 will “kick out” the flow meter measurements from the calculated averages. The flow meters in the array are setup in metric units at the Kurz factory when they are ordered with the Series 255.

Product Approvals

All models in the Series 255 product line have been designed and manufactured in accordance with the following safety and industrial standards.

- Electrical Standard IEC 61010-1 General safety requirements for electrical equipment for measurement, control, and laboratory use.
- IEC 60079-0 General requirements for construction, testing and marking of Ex equipment and Ex components intended for use in explosive atmospheres.
- IEC 60079-7 Requirements for the design, construction, testing and marking for electrical equipment with type of protection increased safety “e” intended for use in Class I, Zone 1 hazardous (classified) locations.
- IEC 60079-31 Requirements for the design, construction and testing of electrical equipment and Ex Components protected by enclosure and surface temperature limitation for use in explosive dust atmospheres.

All models in the Series 255 can be ordered for industrial hazardous locations (Haz Loc) or industrial non-hazardous, ordinary locations (Ord Loc). Markings on the product label indicate the area of intended use and installation. The product label is affixed to the outside of the enclosure.

Models in the Series 255 intended for use in hazardous locations have a product label similar to the example shown in Figure 1-2.

Figure 1-2. Example — Model 255DC Product Label for Hazardous Locations

Models in the Series 255 intended for use in ordinary locations have a product label similar to the example shown in Figure Figure 1-3.

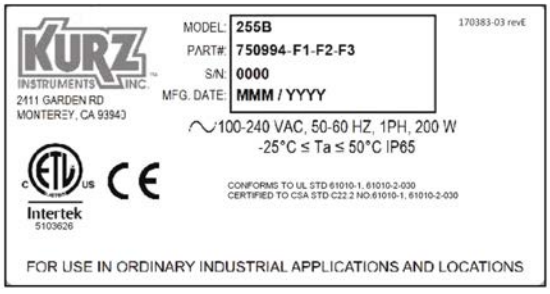


Figure 1-3. Example — Model 255B Product Label for Ordinary Locations

Hazardous Locations Specific Conditions of Safe Use

The following conditions for safe use are required when the Series 255 is installed in hazardous locations:

- Adjusting the potentiometers on the DC power supply is allowed only when an explosive atmosphere is not present.
- The equipment is used only in an area of at least pollution degree 2, as defined in IEC 60664-1.
- If the cables used with the conduit hubs are not provided with their own strain relief, flexible sheathed cables and strain relief devices must be used that have passed a tension test in accordance with IEC 60079-01, section A.3.1.4.
- For ambient temperatures below -10°C and above +60°C, use field wiring suitable for both minimum and maximum ambient temperatures.

Guidance on Preventing Electrostatic Discharge

Sources of ignition are a primary concern in explosive atmospheres. Additional protection from static electricity and electrostatic discharge is an important consideration when installing equipment in hazardous locations. Grounding or earthing is the most effective method for avoiding or minimizing the hazard due to static electricity. Other means for minimizing electrostatic discharge or preventing the electrostatic charge from sources include:

- Wearing protective devices
- Using antistatic work clothes or smocks
- Using antistatic footwear or heel straps
- Discharging any accumulated charge on the body by placing a hand on a grounded surface
- Educating and training on ESD preventive measures

Reference Documents

For additional information, refer to the following Kurz documentation:

- Series 255 Field Wiring Diagram - Customer I/O Connections (DCN 342062)
- Series 255 Field Wiring - Flow Element Electronics (DCN 342063)

Chapter 2

Installation

Overview

This chapter provides installation guidelines and requirements for your Series 255 Flow Averaging Transmitter and flow sensing components.

Safety Considerations

Safety considerations are an important element for proper system installation. Actively thinking about the safety of yourself and others, as well as the condition of your equipment, is of primary importance. We recommend reviewing the following safety considerations.

There are several aspects of the installation that must follow safety and procedure guidelines. Third-party product safety approvals and EMC/EMI compliance require proper installation. Read and thoroughly understand the installation requirements before attempting to install the device and associated devices that make up the system. Improperly installing your devices could impair the safety protections designed into the equipment and could void your warranty. If you have any questions, contact your Kurz customer service representative before attempting installation.

Warning ***Risk of electric shock. When installing and connecting the Series 255 for the first time, connect the protective earth to the ground terminal in the enclosure before the power is supplied.***

Explosion Hazard – Do not service the device or replace components unless power has been disconnected.

After opening the enclosure door and opening the front panel, there is a risk of electric shock as shock protection is removed! Disconnect power from the Series 255 before accessing the electronics compartment.

The main power should be connected to the Series 255 through an external disconnect or circuit breaker with a 20 A maximum rating. The disconnect or circuit breaker should be clearly labeled and located in the vicinity of the Series 255 electronics enclosure and where operators and maintenance personnel have quick and easy access to it.

Enclosure Mounting

The Series 255 electronics can be wall-mounted or rack-mounted. The wall-mounted enclosures for non-hazardous locations are polycarbonate or stainless steel, which provide tough, weatherproof, corrosion resistance with NEMA 4X / IP 65 ratings. The stainless steel enclosure for hazardous locations is rated IP66. The rack mount drawer is for mounting in a control room electronics cabinet and rated for indoor-use only. Table 2-1 shows the enclosure sizes and weights for the Series 255 models.

Table 2-1. Series 255 Enclosure Dimensions & Weight

Enclosure Material	External Dimensions inches [mm]	Enclosure Weight lbs [kg]
Stainless Steel	20 x 16 x 8 [508 x 406.4 x 203.2]	27 [12.2]
	30 x 20 x 8 [762 x 508 x 203.2]	46 [20.9]
Polycarbonate	17.72 x 13.78 x 7.99 [450 x 350 x 203]	15 [6.8]
	24.96 x 21.0 x 9.84 [634 x 534 x 250]	30 [13.6]
Rack Mount	17.19 x 17 x 8.718 [436.6 x 431.8 x 221.4]	20 [9.1]

The stainless steel enclosures are windowless with the display/keypad module mounted on the inside of the enclosure. An optional window is available for viewing the display without opening the enclosure door.

Mounting Guidelines

Caution ***The polycarbonate and stainless steel enclosures are rated IP65 and NEMA 4X. They are suitable for mounting outside, but this should be above any flood level, away from any overflow path, and away from direct sunlight.***

Do not mount the Series 255 on a structure that is subject to vibration, or in a position where damage may be caused by impact, thermal stress, or liquid ingress.

To conform with safety requirements, the wall on which the Series 255 is mounted should be capable of supporting four times the enclosure weight (as specified in Table 2-1).

The ambient temperature may not exceed the permissible range of -25°C to 50°C (-13°F to +122°F).

Always install the wall-mount housing in such a way that the cable entries are pointing down.

The stainless steel enclosures must be mounted such that there is at least a 2-inch air gap between the wall and the backside of the enclosure.

Note The Series 255 is supplied with conduit hubs for connections to the mains power supply, output signals, and flow sensors. The supplied conduit hubs when properly affixed to cable conduit will maintain the Type 4X and IP ratings of the Series 255 electronics enclosure.

The Series 255 wall-mount enclosure options require a flat surface or mounting rails. The location must be is easily accessible with enough room to open the enclosure door at any time. There are three wall-mounted enclosure styles available for the Series 255 and each has different mounting.

Polycarbonate Enclosures

The polycarbonate enclosure is mounted using the included wall mounting brackets and screws. Figure 2-1 shows an example of a rail-mounted polycarbonate unit. Ensure that the mounting screws drive into a wall stud that can support at least four times the listed weight of the unit.

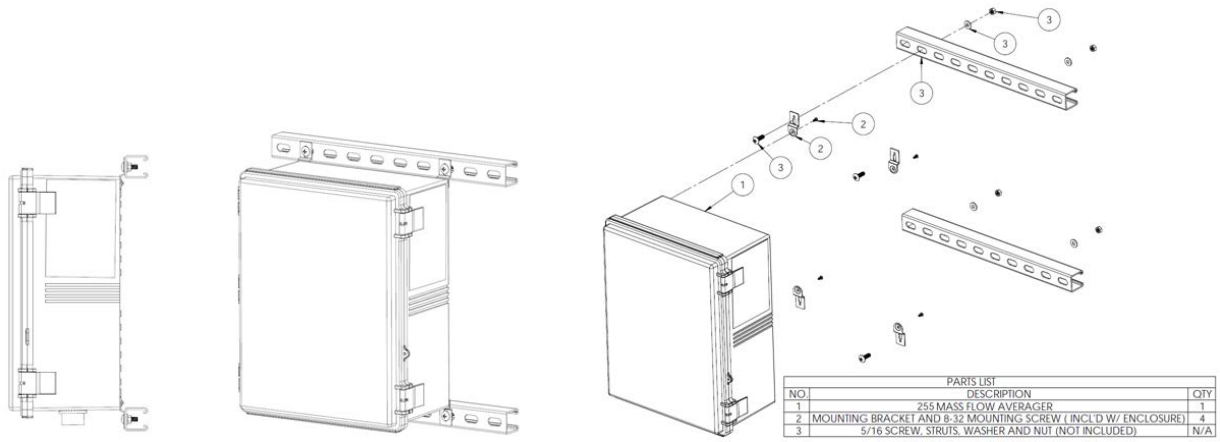


Figure 2-1. Polycarbonate Enclosure — Rail-Mounted Example

Stainless Steel Enclosures

There are two stainless steel enclosure types:

- Stainless steel enclosures for use in non-hazardous, ordinary locations (IP65).
- Stainless steel enclosures for use in hazardous locations (IP66).

Stainless Steel Enclosures for Ordinary, Non-Hazardous Locations

The stainless steel enclosures intended for non-hazardous locations have four 0.5-inch through holes on the inside back wall of the enclosure that are used for mounting the enclosure, as shown in Figure 2-2.

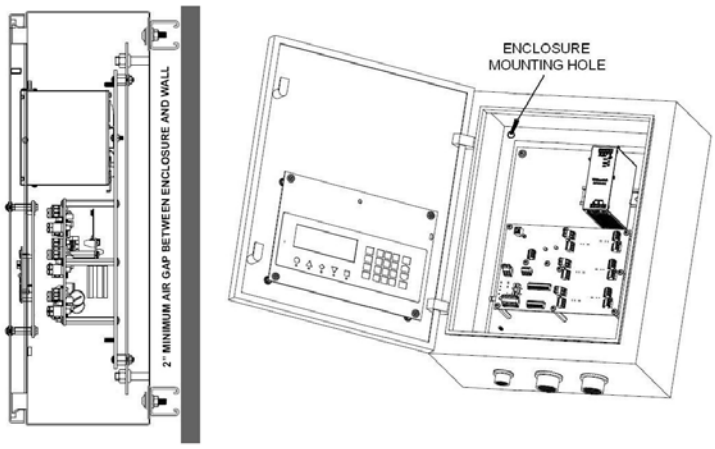


Figure 2-2. Stainless Steel Enclosure — Inside Mount Example

Stainless steel enclosures should be mounted on rails attached to studs on the wall to allow a minimum 2-inch air gap between the wall and the backside of the enclosure. Ensure the screws/bolts used for mounting the rails to the wall go into wall studs that can support at least four times the listed weight of the unit. All mounting hardware (except the mounting rail) is included, and it must be used and installed as specified to maintain the NEMA 4X rating of the enclosure. See Figure 2-3 for the rail mounting detail.

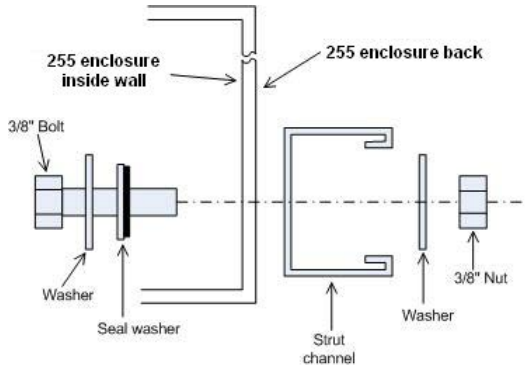


Figure 2-3. Stainless Steel Enclosure — Mounting Hardware Stack Detail

Stainless Steel Enclosures for Hazardous Locations

The stainless steel enclosures intended for hazardous locations have mounting feet welded at four places on the back of the enclosure, as shown in Figure 2-4. These enclosures should be mounted on rails attached to studs on the wall to allow a minimum 2-inch air gap between the wall and the backside of the enclosure. Ensure the screws/bolts used for mounting the rails to the wall go into wall studs that can support at least four times the listed weight of the unit. All mounting hardware (except the mounting rail) is included.

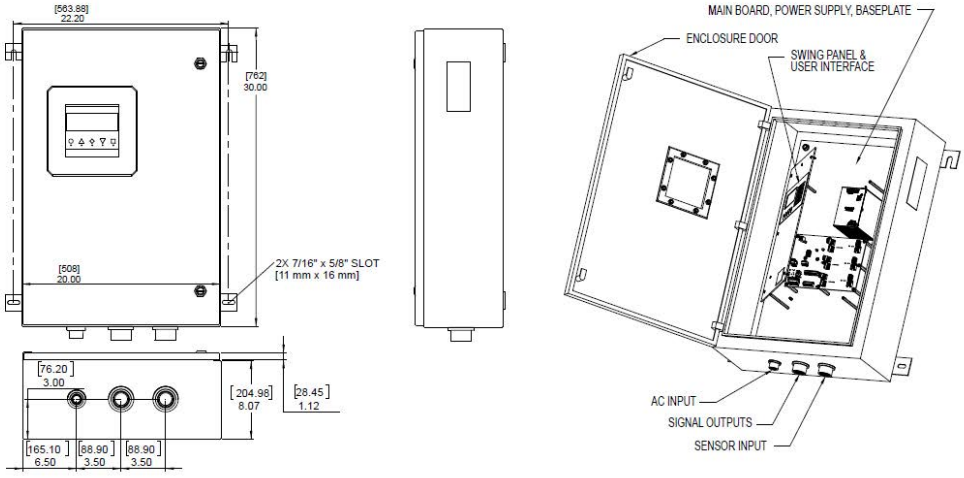


Figure 2-4. Stainless Steel Enclosure for Hazardous Locations

Rack Mount Chassis

The rack-mount location for installing the Series 255 chassis should be a clean, dust-free area that is well ventilated. Avoid areas where heat, electrical noise, and electromagnetic fields are generated. There are a variety of rack units on the market, so the actual assembly/mounting procedure may differ slightly from these instructions:

1. The rack mount chassis is shipped with the slide rails attached to the chassis sides.
2. The slide rails will fit a rack between 22” to 25” deep.
3. You may need to remove the slide rails from the chassis to adjust the front and rear brackets that will screw into the rack vertical frame.
4. Mount the slide rail brackets to the front and rear vertical frame rails, as shown in Figure 2-5 and Figure 2-6.
5. Repeat for the second slide on the right rail.

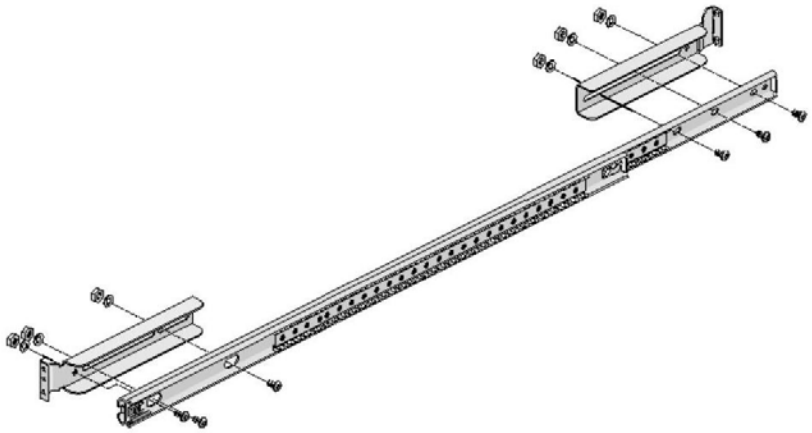


Figure 2-5. Rack Mount Slide Rails Bracket Adjustment Screws

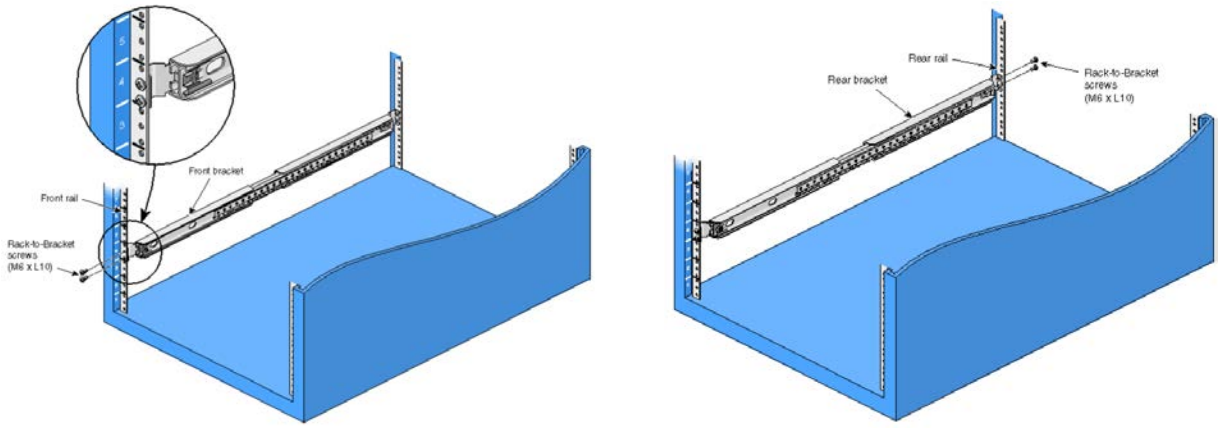


Figure 2-6. Rack Mount Slide Rails Attached to Rack Frame

Electrical Connections

Caution ***Review the following precautionary measures prior to installation:***

- ***Refer installation and service to qualified service personnel only.***
- ***Connections to the AC mains must be performed by a licensed electrician.***
- ***Installation must be done in accordance with the instructions contained in this manual.***
- ***Installation must be done in accordance with local electrical codes.***

The following are general recommendations for wiring the Series 255 and the flow meters connected to the Series 255.

- Always disconnect power before performing maintenance on wiring.
- Use the proper wire gauge.
- Label the wires.
- Observe all local electrical codes dictating the maximum current allowable for each wire gauge. Current above the maximum ratings can overheat the wiring and cause damage.

To guard against coupling noise from one conductor to another, routing electrical connection cables and wiring into and out-of the Series 255 enclosure should be made through the conduit fittings provided on the Series 255 enclosure, as shown in Figure 2-7.

These guidelines are for noise immunity only. Follow all local codes for safety requirements.

- To maintain the Series 255 enclosure NEMA and IP ratings, three conduit fittings on the bottom of the enclosure are provided for AC input power, communication, and 24 VDC connections to and from the flow elements and customer I/O connections.
- The conduit fittings have tapered female threads for rigid conduit or IMC. Ensure the conduit is aligned with the conduit connections so as to prevent unnecessary stress on the enclosure wall. After the conduit and wiring have been installed, ensure the conduit connector locknut is properly tightened to seal the openings into the enclosure.
- It is important to route the various wire connections through the correct conduit entries at the bottom of the Series 255 enclosure. The conduit hubs have been properly spaced so that there is sufficient distance between the AC power line, the signal conductors, and the communication conductors to guard against coupling noise among the conductors.

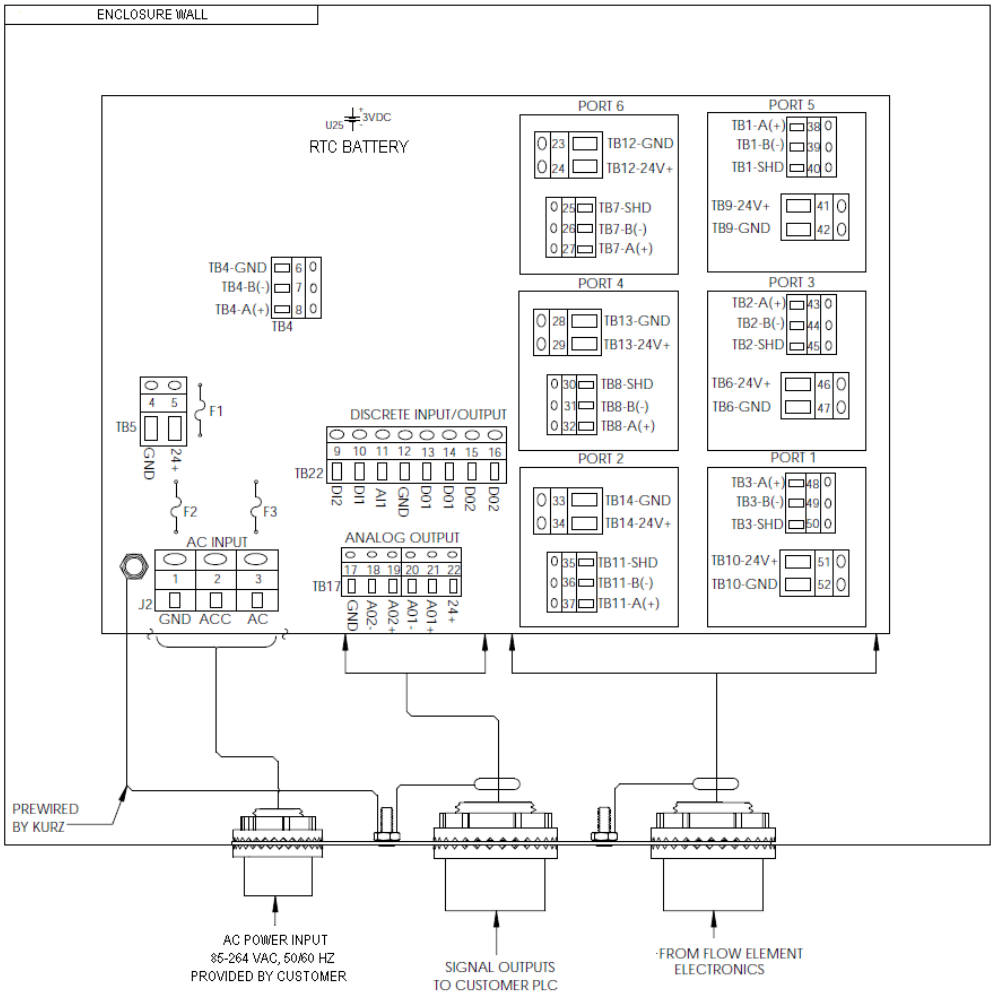


Figure 2-7. Conduit Fittings

Grounding

Proper bonding and grounding are important for safety in electrical installations. For solid-state electronic devices, proper grounding and bonding helps limit the effects of noise due to electromagnetic interference (EMI). Follow the proper local codes and ordinances that dictate which bonding and grounding methods are permissible.

If the conductors are in a metal conduit, each segment of the conduit must be bonded to each adjacent segment so that it has electrical continuity along its entire length. The conduit also must be bonded to the enclosure at the entry point.

The Series 255 electronic panels and enclosure include prewired ground connections that connect the back panel, electronic assemblies, shields, and enclosures.

Important ***Do not disconnect or loosen any prewired ground connections.***
Figure 2-8 shows the ground bonding for polycarbonate enclosures.
Figure 2-9 shows the ground bonding for stainless steel enclosures.

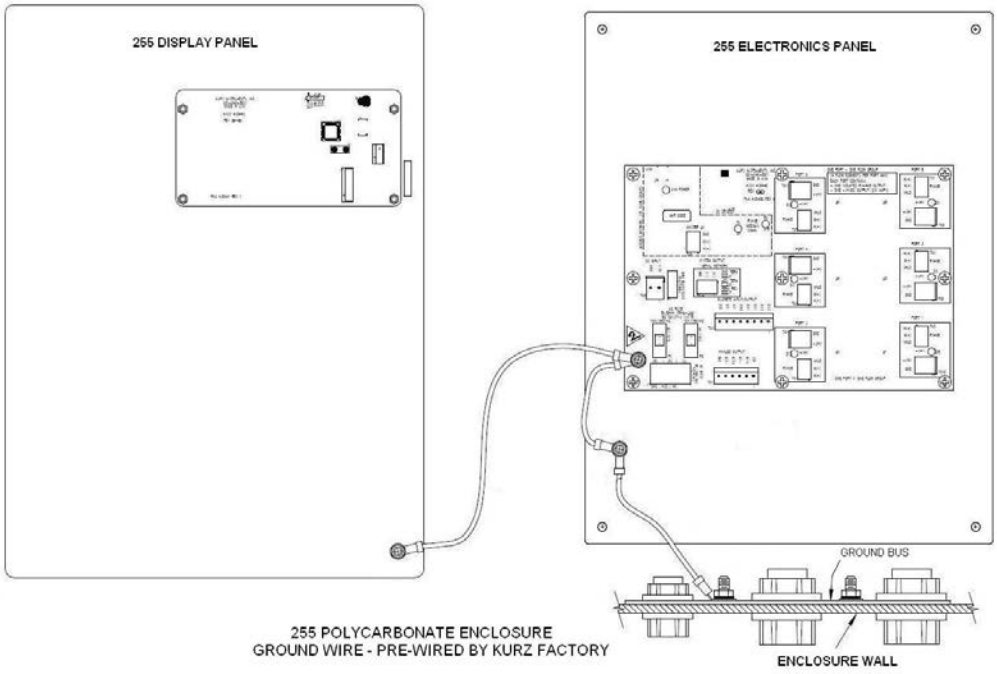


Figure 2-8. Ground Bonding for Polycarbonate Enclosures

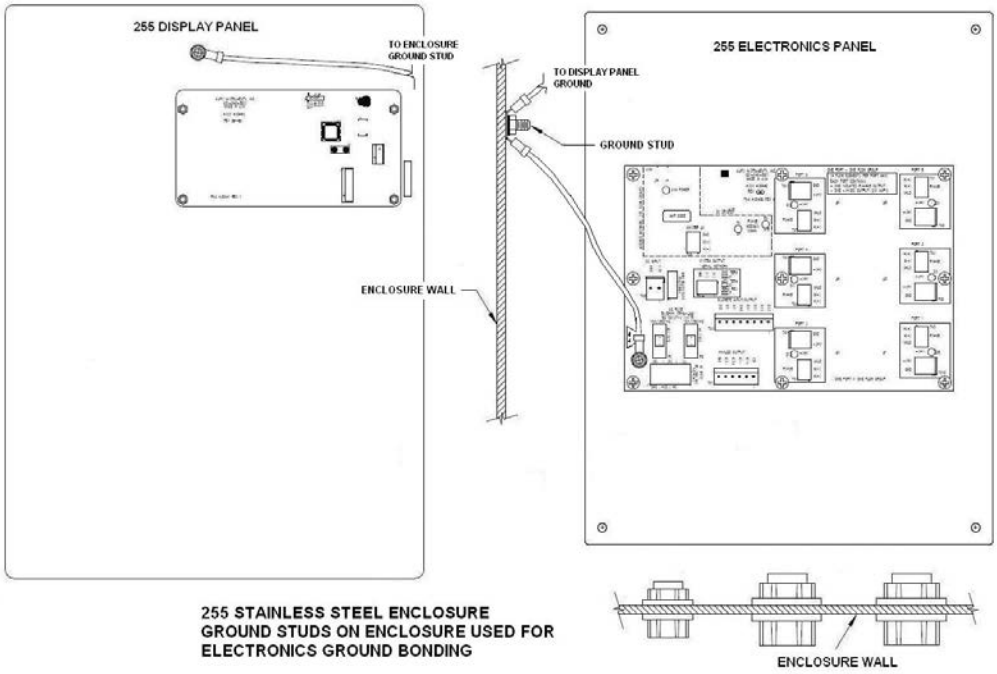


Figure 2-9. Ground Bonding for Stainless Steel Enclosures

These connections ensure the Series 255 is properly grounded to the facility grounding-electrode through a metallic conduit or armored cable. Conduit fittings with NPT threads are pre-installed on the bottom of the Series 255 enclosure for attaching the cabling conduit. To maintain proper earth grounding, ensure a positive connection exists between the Series 255 enclosure and earth. The connecting ground wire must be 14 AWG minimum.

In addition to the grounding required by the Series 255, you must also provide proper grounding for all the flow sensing elements connected to the Series 255. Care must be taken to provide each device with an acceptable grounding path. Refer to the *Kurz B-Series Hardware Guide* and *Kurz B-Series Quick Start Guide* for installation instructions for the flow sensing elements.

- All devices that connect to the 24V power supply (inputs and outputs) or to the RS-485 shield grounds must be referenced to chassis ground. Failure to follow this procedure may result in property damage or personal injury.
- Chassis ground, 24V ground, and the RS-485 shield grounds are internally connected.

Power Supply

The Series 255 flow transmitter can be powered by 100 to 240 VAC or 24 VDC, as specified in the product specification.

- Transmitter Input Power

  The Series 255 Transmitter is designed to be powered by voltages ranging from 100 to 240 VAC (50 to 60 Hz) or 24-30 VDC.

- Supply Wire Requirements

  VAC power supply wire should be 14 to 10 AWG wire (depending on distance from mains).

The AC powered models of the Series 255 and the connected flow sensing elements are powered by the 24 VDC power supply installed in the Series 255 electronics panel. These models require 100-240 VAC, 50-60 Hz, single-phase power from the customer. The Series 255DC model does not have a built-in power supply and is powered by the customer 24 VDC input. Table 2-2 lists the AC and DC input power requirements for each Series 255 model.

Note The maximum number of sensor is dictated by the size of the power supply and the size of the enclosure.

Table 2-2. Series 255 AC and DC Input Power Requirements

Model #	Part #	Max # Flow Sensors	AC Power (W)	DC Current (A)
255A	750993	4	95	3.6
255B	750994	9	200	7.7
255C	750995	16	350	13.5
255DC	750997	16	-	13.5

Note AC and DC power calculations

- Models Series 255A,B,C,RM Power Supply
  Input = 100-240 VAC 50-60 Hz; Output = 24 VDC
- DC Watt = 18 W per sensor (WGF sensor) plus 6 W for Series 255 microprocessor
- DC Current = (DC Watt / 24 V) x 1.1
- Max Power = DC Watt / 0.85 efficiency

The main power should be connected to the Series 255 through an external disconnect or circuit breaker with a 20 A maximum rating. The disconnect or circuit breaker should be clearly labeled and located in the vicinity of the Series 255 electronics enclosure, and where operators and maintenance personnel have quick and easy access to it.

The main input for AC-powered models is routed through the left-most conduit fitting as shown in Figure 2-10. The conductors are terminated at terminal block J2 on the Series 255 electronics panel. This terminal block can accept up to 10 AWG conductors. Kurz recommends using 16 to 10 AWG conductors (depending on distance from mains) for the AC input.

Instrument Wiring

Figure 2-10 shows the connection terminals on the main board of the Series 255. Table 2-3 lists the descriptions of the terminal connections. Refer to Appendix A for complete Series 255 wiring diagrams.

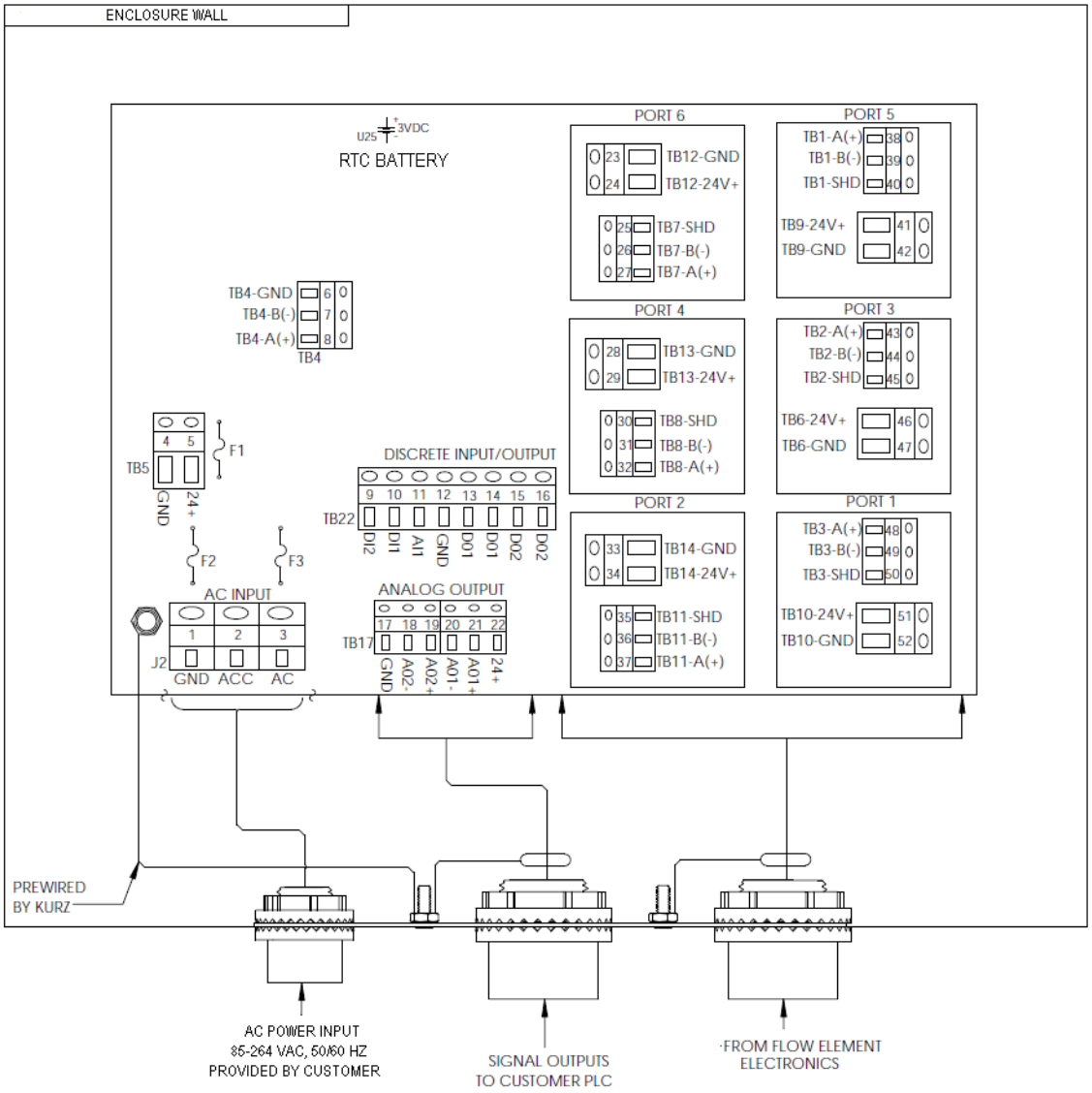


Figure 2-10. Terminal Connection Layout

Table 2-3. Terminal Connection Descriptions

Pin #	Name	Description
1	GND	VAC Ground
2	ACC	VAC Common (Neutral)
3	AC	VAC Power Input (85-264, 50/60 Hz) (Line)
4	GND	Ground (+24 VDC Return)
5	24+	+24 VDC Input (for Series 255 Power)
6	TB4-GND	Modbus Master #2 - RS485 Shield
7	TB4-B(-)	Modbus Master #2 - RS485 (Negative)
8	TB4-A(+)	Modbus Master #2 - RS485 (Positive)
9	DI2	Digital Input #2, Short to GND to Activate Zero/Span Cycle
0	DI1	Digital Input #1, Short to GND to Activate Purge
11	AI1	Analog Input #1, 0 to 20 mA Input, Non-Isolated
12	GND	Ground (for AI1, DI1, DI2)
13	DO1	Digital Output #1, SSR Terminal A, Isolated SSR
14	DO1	Digital Output #1, SSR Terminal B, Isolated SSR
15	DO2	Digital Output #2, SSR Terminal A, Isolated SSR
16	DO2	Digital Output #2, SSR Terminal B, Isolated SSR
17	GND	Ground (for Analog Output #1 and #2)
18	AO2-	Analog Output #2 (Negative) 4-20 mA Current
19	AO2+	Analog Output #2 (Positive) Input Power Connection
20	AO1-	Analog Output #1 (Negative) 4-20 mA Current
21	AO1+	Analog Output #1 (Positive) Input Power Connection
22	24+	+24 VDC Output (for Analog Output #1 and #2)
23	TB12-GND	Port #6 - Ground (+24 VDC Return)
24	TB12-24V+	Port #6 - +24 VDC Output
25	TB7-SHD	Port #6 - RS485 Shield
26	TB7-B(-)	Port #6 - RS485 (Negative)
27	TB7-A(+)	Port #6 - RS485 (Positive)
28	TB13-GND	Port #4 - Ground (+24 VDC Return)
29	TB13-24V+	Port #4 - +24 VDC Output
30	TB8-SHD	Port #4 - RS485 Shield

Table 2-3. Terminal Connection Descriptions (continued)

Pin #	Name	Description
31	TB8-B(-)	Port #4 - RS485 (Negative)
32	TB8-A(+)	Port #4 - RS485 (Positive)
33	TB14-GND	Port #2 - Ground (+24 VDC Return)
34	TB14-24V+	Port #2 - +24 VDC Output
35	TB11-SHD	Port #2 - RS485 Shield
36	TB11-B(-)	Port #2 - RS485 (Negative)
37	TB11-A(+)	Port #2 - RS485 (Positive)
38	TB1-A(+)	Port #5 - RS485 (Positive)
39	TB1-B(-)	Port #5 - RS485 (Negative)
40	TB1-SHD	Port #5 - RS485 Shield
41	TB9-24V+	Port #5 - +24 VDC Output
42	TB9-GND	Port #5 - Ground (+24 VDC Return)
43	TB2-A(+)	Port #3 - RS485 (Positive)
44	TB2-B(-)	Port #3 - RS485 (Negative)
45	TB2-SHD	Port #3 - RS485 Shield
46	TB6-24V+	Port #3 - +24 VDC Output
47	TB6-GND	Port #3 - Ground (+24 VDC Return)
48	TB3-A(+)	Port #1 - RS485 (Positive)
49	TB3-AB(-)	Port #1 - RS485 (negative)
50	TB10-SHD	Port #1 - RS485 Shield
51	TB10-24V+	Port #1 - +24 VDC Output
52	TB10-GND	Port #1 - Ground (+24 VDC Return)

The terminal connections on the Series 255 main board are located underneath the display panel. A Phillips screwdriver is needed for removing the screws that will allow the display panel to swing open and permit access to the terminals for wire connections. The removable screws on the display panel are shown in Figure 2-11 for the various enclosure models.

- For the Models 255A, 255B, and 255DC polycarbonate enclosure (smallest size), there are two screws on the right-hand side that need to be removed to open the swing panel.
- The other wall mount enclosures have the display panel mounted on standoffs above the Series 255 terminal board. Two of the standoffs are hinged so that the display board does not have to be removed to access the wiring terminals. The screws that need to be removed to allow the display panel to swing open to access the wiring terminals are marked.

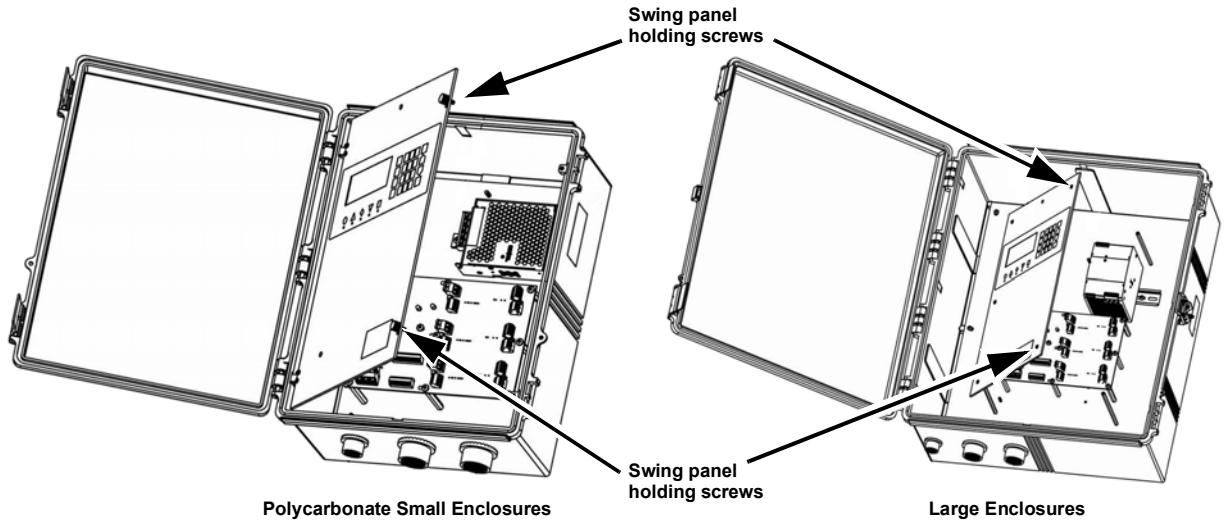


Figure 2-11. Swing Panel Holding Screws

Wire gauge, torque, and wire-stripping recommendations for the Series 255 are listed in Table 2-4.

Table 2-4. Instrumentation Wiring Recommendations

Connection	<150 ft	150 ft to 250 ft	250 ft to 500 ft	>500 ft	Tightening Torque lb-ft [Nm]	Stripping Length inches [mm]
AC Power Input	16 AWG	14 AWG	12 AWG	10 AWG	0.37-0.44 [0.5-0.6]	0.31 [8]
24 VDC Output to Flow Sensing Units	14 AWG	12 AWG	10 AWG		0.37-0.44 [0.5-0.6]	0.31 [8]
RS-485 to Flow Sensing Units	24 to 18 AWG Shielded Twisted Pair				0.37-0.44 [0.5-0.6]	0.27 [7]
4-20 mA Output	26 to 16 AWG Shield Twisted Pair				0.37 [0.5]	0.24 [6]

Connecting the Flow Sensing Units

Install the flow elements according to the *Kurz Quick Start Guide* and *Kurz B-Series Hardware Guide*.

Flow Element Installation

The Series 255 is designed to provide 24 VDC power to the individual flow sensing units over a two-wire electrical connection. There are six ports on the Series 255 main board that provides 24 VDC power and isolated RS-485 communication lines to the flow sensors. Each port powers up to four flow sensing units (such as a 4-point K-BAR).

The communication and the power connections between the Series 255 and the flow sensing units are routed through the right-most conduit fitting as shown in Figure 2-10.

RS-485

The RS-485 connection between the Series 255 and the flow elements must be shielded, twisted-pair cable at least 24 AWG. Kurz recommends using cable with foil and braided shield with > 90% coverage and a cable impedance of 120 Ohm (Kurz P/N: 270082). The cable shield should be grounded at the Series 255 and at the flow sensing electronics to limit RFI/EMI interference. When using the braided shield on the cable for a ground wire, it must be less than 2 inches long.

The RS-485 connections between the Series 255 and the flow sensors are not polarity sensitive. This means that the signal wires between the Series 255 and the flow sensors can be connected in any order (positive (+) and negative (-) terminals can be reversed) and will not affect communication.

24 VDC

For the 24 VDC connection between the Series 255 and the flow elements, the wire size is dependent on the distance between the flow sensor electronics, the Series 255, and the number of sensors (if it is a multipoint sensor). The table below shows the wire size for a 2-, 3-, and 4-point K-BAR.

Table 2-5. 24 V Wire Size Chart

2- and 3-Point K-BAR		4-Point K-BAR	
Distance (ft.)	**AWG**	**Distance (ft.)**	**AWG**
0-75	18	0-50	18
75-100	16	50-100	16
125-200	14	100-150	14
200-325	12	150-200	12
325-500	10	200-325	10

Typical terminal connections between a Series 255 and Kurz B-Series flow meters are shown in Figures 2-12, 2-13, and 2-14. However, Kurz provides specific point-to-point wiring diagram for each Series 255 system.

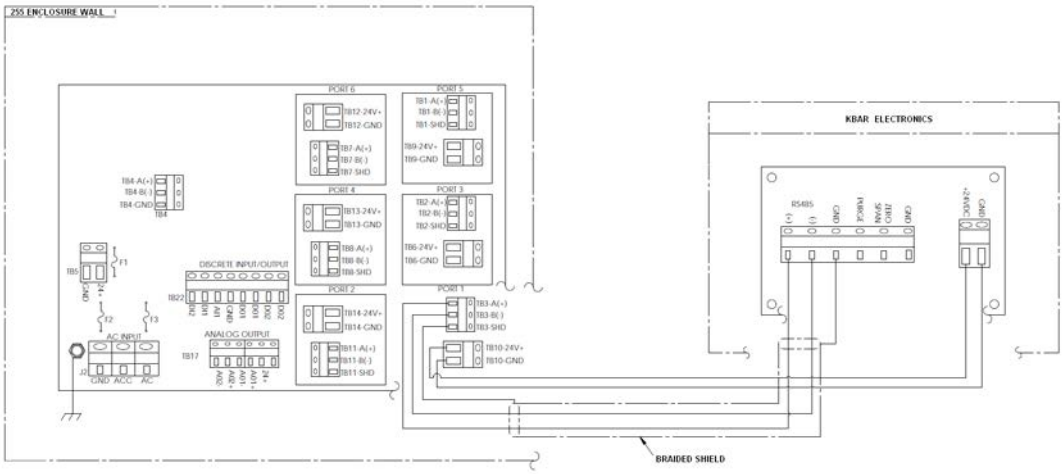


Figure 2-12. Example — Wiring from a Series 255 to a Multipoint K-BAR 2000B

If the system consists of multiple K-BARs, each K-BAR is connected to separate Series 255 port terminals – both 24 VDC and RS-485.

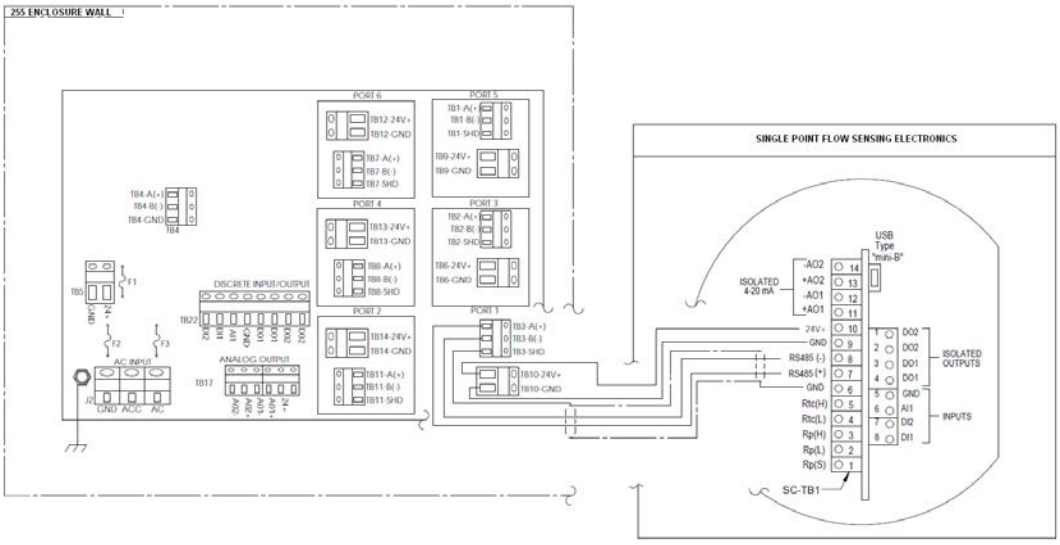


Figure 2-13. Example — Wiring from a Series 255 to a Single-Point 454FTB (Transmitter-Attached)

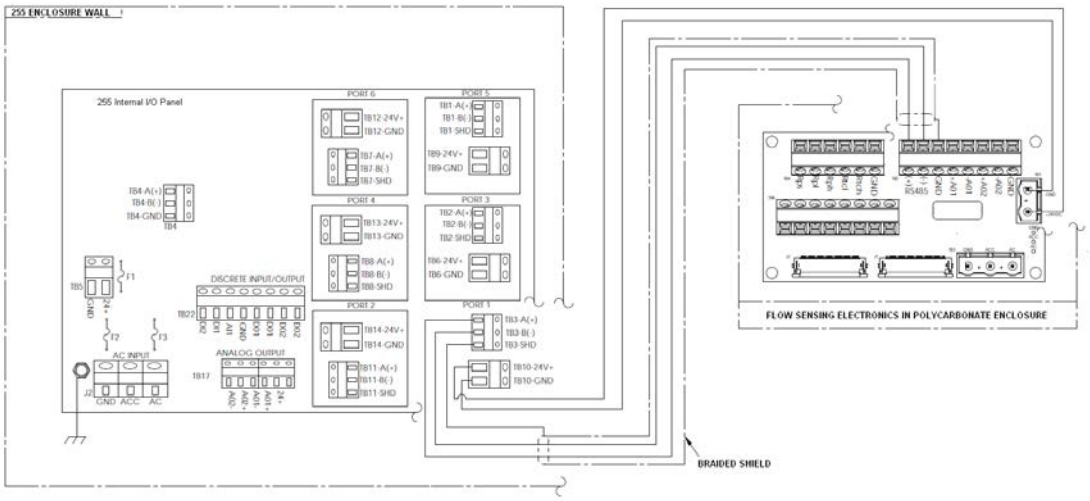


Figure 2-14. Example — Wiring from a Series 255 to a Single-Point 454FTB (Transmitter-Separate, polycarbonate)

Modbus Wiring for Multiple Single-Point Flow Meters

The Series 255 has six built-in ports. Each port is capable of supporting four B-series flow elements.

- A Series 255 used with six or less single-point flow meters must connect each flow meter to its own port on the Series 255.
- When 7 to 16 single-point flow meters are used, the following wire recommendations should be followed for the Modbus connections between the Series 255 and single-point flow sensors:
  - A maximum of four sensors on any one port of the Series 255.
  - The sensors should be balanced as evenly as possible between the six Series 255 ports.
  - Any port with multiple single-point sensors should have the Modbus wiring the flow meters in the recommended daisy chain configuration (Figure 2-15) or with sensors on short stubs (3m max)(Figure 2-16). The recommended wiring configuration reduces reflections that can cause communication problems.

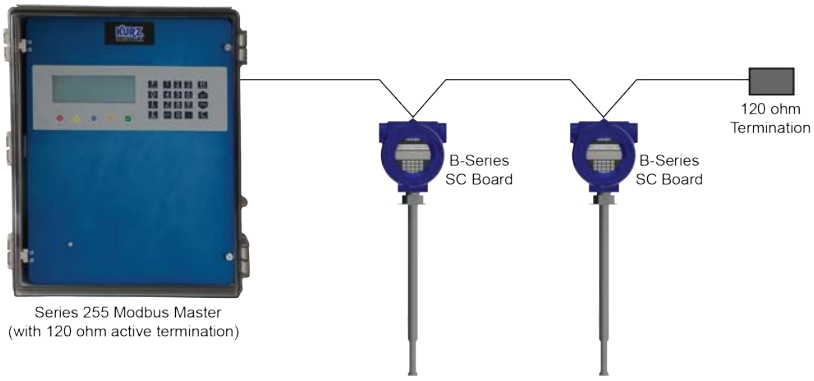


Figure 2-15. Daisy Chained Flow Meters in Recommended Configuration

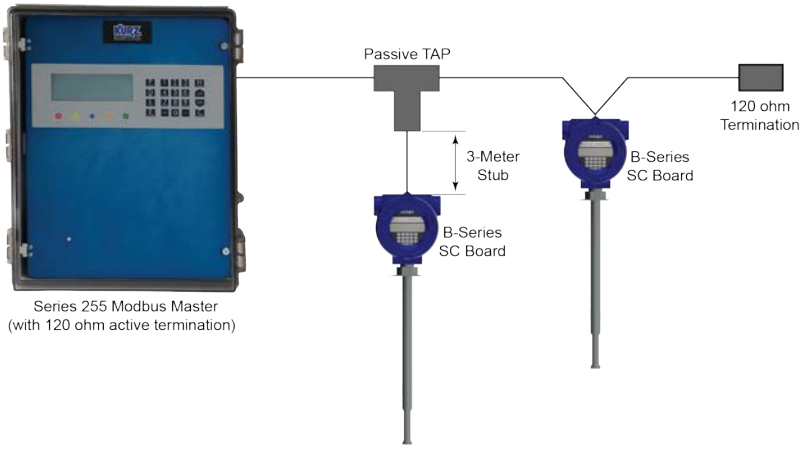


Figure 2-16. Daisy Chained Flow Meters in a Configuration using Short Stubs

A 2-to-1 ferrule should be used for the daisy chain wiring. In this case, two wires go into one ferrule and are crimped together. The correct ferrule must be used based on the wire sizes. The ferrules should be used for the RS485+, RS485-, and shield wires. When completed, three pairs of crimped wires are used in each single-point enclosure as shown in Figure 2-17.

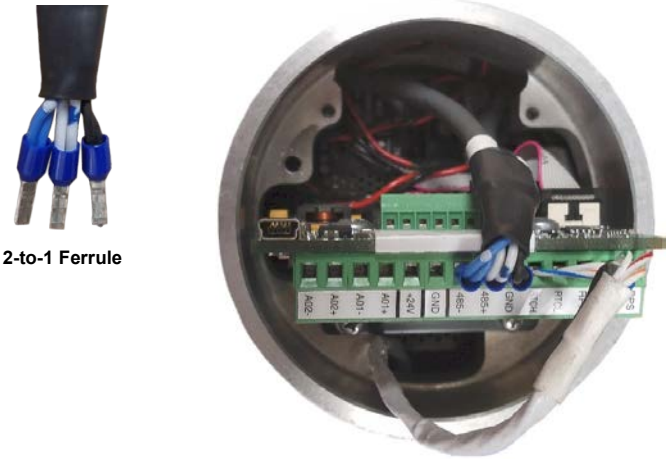


Figure 2-17. Example of 2-to-1 Ferrule used with a Single-Point Flow Meter

I/O Connections

4-20 mA Output

The Series 255 provides two 4-20 mA current loop channels via the TB17 terminal block. The terminal block accepts 26 to 16 AWG wire. For this connection, route the wires through the center conduit fitting at the bottom of the enclosure and connect to terminal block TB17. Figure 2-18 shows the configuration for the 4-20 mA outputs. The Series 255 is shipped with the jumpers installed for the 4-20 mA outputs being powered by the Series 255.

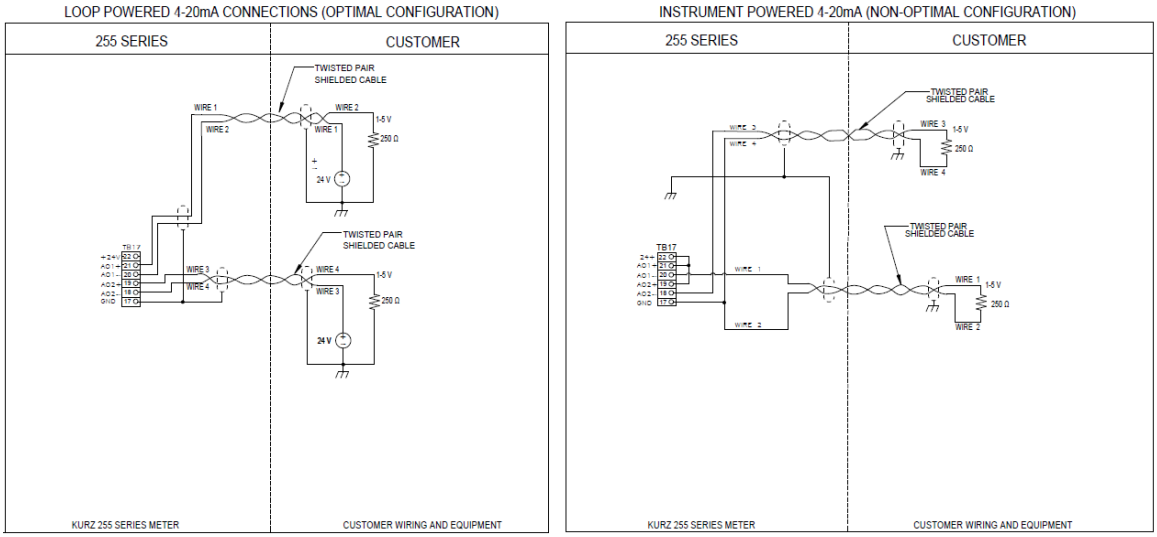


Figure 2-18. 4-20 mA Outputs

USB Port

The Series 255 features a USB port for data logging. The USB port is on the microprocessor board underneath the main board. A USB cable is provided with the Series 255 for direct connection to a computer with a USB A-Type port. The data streamed through this port can be retrieved by a remote terminal application and stored in a CSV file format. The data is logged every 1 second to the port and includes average velocity, average temperature, and Series 255 status in comma-separated format. The data logging feature is turned OFF by default, but can be turned ON or OFF by the user.

Modbus RS-485 Service Port

The Series 255 features two Modbus ports for a convenient communication connection to individual flow sensing devices, as shown in Figure 2-19. Both connection cannot be used at the same time.

- The RS-485 USB mini-B female port connects directly to a computer with a USB A-Type port. This connection provides the built-in conversion from RS-485 to USB to communicate directly with the flow meter sensors for service, troubleshooting, or programming changes. The computer must have a Modbus master application installed, such as the Kurz application KzComm (see the *KzComm User's Guide* for additional information).
- The RS-485 3-pin terminal block for a twisted pair cable supports connecting to a Modbus master.

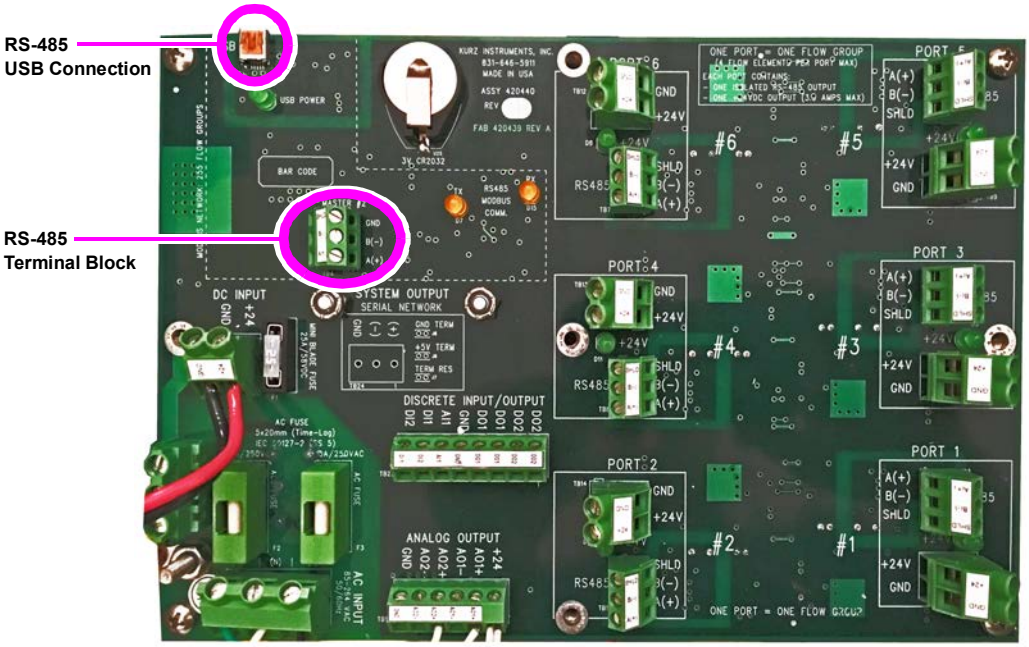


Figure 2-19. Service Port Locations

Operation and Setup

Verify the wiring and then apply power to the Series 255. The Series 255 takes approximately 45 seconds for complete startup (including flow sensor units) and to begin providing valid flow and temperature measurements. The communication LEDs should be continuously blinking, and the port power LEDs should always be ON, as shown in Figure 2-20.

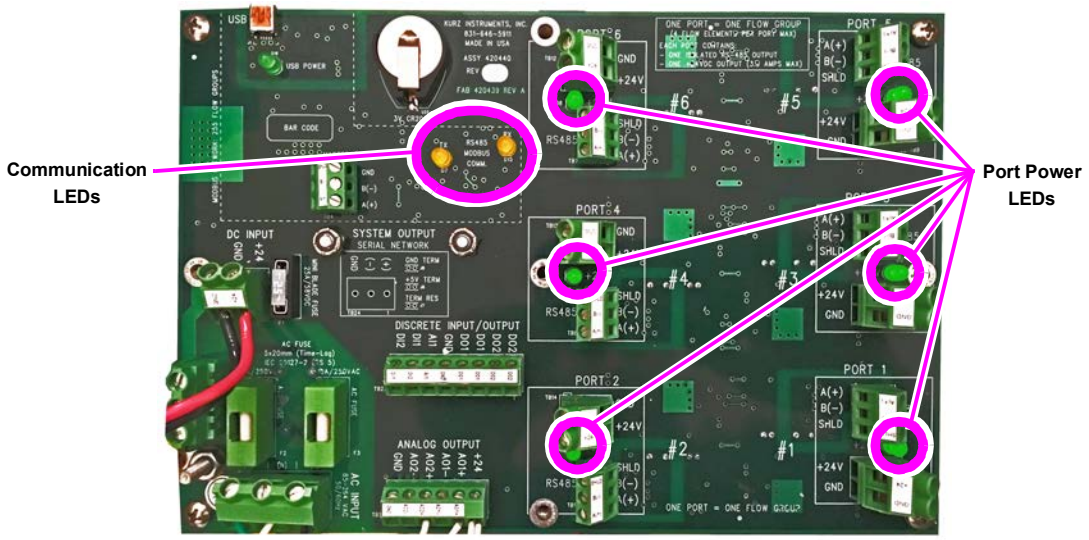


Figure 2-20. System Board LEDs

The system is functioning without error when the normal (green) status indicator on the front panel is ON and the words “NO EVENTS” appears on the last line of the display, as shown in Figure 2-21. If any other status indicators are ON then an event message appears on the last line of the display that provides a description of the error or fault.

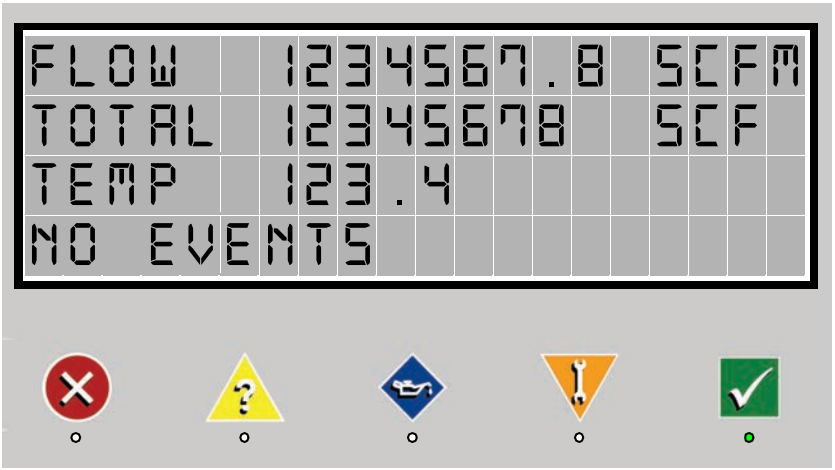


Figure 2-21. Example — Front Panel Status Indicators, System Operating Without Error

Wait at least 2 minutes for the flow measurement to stabilize on the front panel display. There are no actions needed for operating the flow meter using the default flow meter settings. There is no special shutdown procedure for the flow meter and flow sensing units, simply remove the operating power. Removing power from the Series 255 will also shutdown the flow sensing units.

Check the 4-20 mA output signals against the process values on the front panel display. If the output signal is zero, out-of-range for the expected values, or obviously incorrect, turn OFF power and refer to the Troubleshooting chapter.

Replacing the Power Fuses

Warning ***Risk of electric shock.***
Do not remove or replace any fuses while the Series 255 is powered on.

The AC input and the 24 VDC input are both individually fused. If any fuses need to be replaced, use the type and value specified in Table 2-6.

Table 2-6. Fuse Requirements

Fuse	Type	Value	Suggested Replacement
AC Fuse	Ceramic, 5x20mm SLO-BLOW	10 A, 250 VAC	Bel fuse PN 5HT 10-R
			Littelfuse PN 0215010.MXP
			Eaton PN BK/S505-10-R
			Schurter Inc PN 0001.2514
DC Fuse	LP Mini Blade, Fast blow	25 A, 58 VDC	Littelfuse PN 0891025.NXS

The locations of the fuses on the main board are shown in the Figure 2-22.

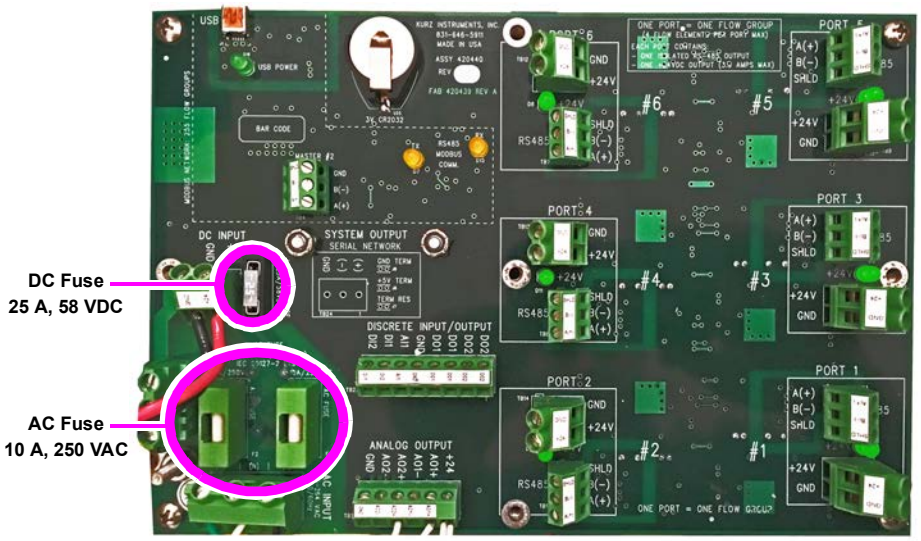


Figure 2-22. Location of System Board Fuses

AC Fuses

To replace the AC fuse:

1> Disconnect power to the Series 255.

2> Open the enclosure lid.

For polycarbonate models, the enclosure lid is secured by quick-snap latches. A front panel inside of the enclosure must be opened to access the electronics. The panel is secured with screws that require a screwdriver.

For stainless steel models, a screwdriver is required to release the securing latches for the enclosure lid.

3> Remove the protective cap.

4> Remove the old fuse and replace it with a new fuse.

Only use the fuse type specified in Table 2-6.

5> Replace the protection cap.

6> Close and secure any front panel covers and enclosure lid.

7> Restore power to the Series 255, and confirm it starts up normally.

DC Fuses

To replace the DC fuse:

1> Disconnect power to the Series 255.

2> Open the enclosure lid.

For polycarbonate models, the enclosure lid is secured by quick-snap latches. A front panel inside of the enclosure must be opened to access the electronics. The panel is secured with screws that require a screwdriver.

For stainless steel models, a screwdriver is required to release the securing latches for the enclosure lid.

3> Remove the old fuse using your fingers or a fuse puller.

4> Insert a new fuse.

Only use the fuse type specified in Table 2-6.

5> Close and secure any front panel covers and enclosure lid.

6> Restore power to the Series 255, and confirm it starts up normally.

Replacing the Battery

Important ***When you connect or disconnect the battery, an electrical arc can occur. This could cause an explosion in hazardous location installations. Be sure that power is removed before proceeding to replace the battery.***

A coin-type 3.0 volt lithium battery is shipped with the Series 255. It is installed on the Series 255 main board and powers the real time clock on the Series 255 microprocessor. Typical service life of the battery is two years. Figure 2-23 shows the location of the lithium battery on the main board.

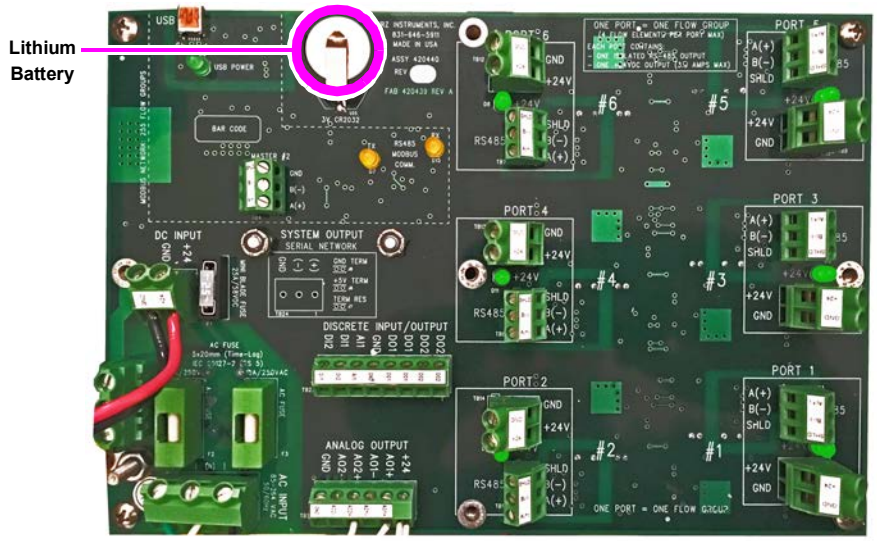


Figure 2-23. Location of the Lithium Battery

If you are replacing the battery, you must use an exact replacement battery:

Important ***Use only the battery size and type specified. Do not use any other type or size of battery.***

- Lithium battery
- Size 2032
- 3.0 V, 225 mAh
- Kurz PN 320031, Panasonic CR2032, or Energizer CR2032VP

Install the battery in the coin cell holder with the positive (+) side facing up.

After replacing the battery you must reset the clock to the correct time.

Chapter 3

Diagnostics & Troubleshooting

Overview

This chapter provides diagnostic and troubleshooting for the Series 255 Flow Averaging Transmitter.

The error handling of the Series 255 is designed to support the following alarm specifications:

- NAMUR Specification NE-43
- NAMUR Specification NE-107
- EN 15267 – Certification of AMS (QAL1)

The troubleshooting section provides information for the most common operating problems. There is also guidance in troubleshooting communication issues between the Series 255 and the flow sensor channels.

Event Notification

There are several methods that the Series 255 uses to notify the user of system abnormalities:

- Messages appear on the local display as a text string.
- Activating an alarm output.
- Indicating as a low/high level on the 4-20 mA outputs (NE-43).
- Indicating as a status indicator on the front panel (NE-107).
- Associating with data quality status of the process variables.

Local Display Event Line

Line four on the Series 255 front panel display provides system messages and events.

- System messages are momentary prompts that appear for three seconds and then automatically clear. These messages are usually triggered by user interaction with the system via the local keypad.
- System events are triggered by irregular or abnormal system states or system events. The event text appears as long as the event is active. If there is more than one event, all active events will scroll.

If no events are active then “NO EVENTS” appears on line 4. Whenever a new event is triggered, it is added to the event log with a time stamp. Table 3-1 lists the triggers for system events.

Table 3-1. System Events and Triggers

Bit Code	Event Text	Trigger
0x00	NO EVENTS	Normal – no errors
0x01	ALL CHANNELS FAILED	All channels have fault (SYSTEM SENSOR FAIL).
0x02	MODBUS COMM FAIL	All channels have communication fault (SYSTEM COMM FAIL).
0x04	SYSTEM OFFLINE/MAINT	Flow averaging transmitter put in MAINTENANCE MODE (SYSTEM MAINTENANCE) or Zero Span check is active.
0x08	FLOW OUT OF RANGE	A flow average is calculated but it is out of range low or high.
0x10	TEMP OUT OF RANGE	A temperature average is calculated but it is out of range low or high.
0x20	WRN-CHAN KO AT MIN	Number of channels left is at minimum.
0x40	WRN-TOTAL AT HIGH SP	Flow Totalizer has reached a user-specified maximum.

Table 3-1. System Events and Triggers (continued)

Bit Code	Event Text	Trigger
0x80	WRN-ELEC TEMP OV LIM	Electronics temperature of Series 255 board is over limit.
0x100	WRN-CHANNEL KICKOUT	One or more channel is kicked out of the average.

The Event Log contains a historical record of the last 260 fault events reported by the Series 255. The Event Log is stored in nonvolatile memory (EEPROM) on the Series 255. Each event record contains the event error code and a timestamp (date and time) when the error code was triggered.

Series 255 Alarm Outputs

There are two alarms on the Series 255 that are each linked to an optically coupled solid state relay (SSR). Each SSR is rated for 0.5A, 24 VDC. The relays can be used to interface with external audible alarms or warning lamps. Alarm 1 is linked to DO1 and Alarm 2 is linked to DO2. By default, the system is shipped so that Alarm 1 triggers on a SYSTEM FAIL event and Alarm 2 triggers on a SYSTEM OFFLINE event. Each of the alarms can be configured to trigger on the events listed in Table 3-2.

Table 3-2. Alarm Triggers

Alarm Event	Description
System Fail	SYSTEM SENSOR FAIL or SYSTEM COMM FAIL
System OFFLINE	SYSTEM MAINTENANCE
Channel Kickout	CHANNEL KICKOUT AT MIN
Zero/Span Check Active	ZERO SPAN CHECK CYCLE IS ACTIVE
Flow out of range	FLOW OUT OF RANGE (low or high)
Temp out of range	TEMPERATURE OUT OF RANGE (low or high)

NAMUR NE-43

Namur NE-43 specifies how a sensor fault is indicated using the 4-20 mA output signal. The fault indicators can be configured to be either low (3.6 mA) or high (21.0 mA). An NE-43 alarm indication is triggered under the following conditions:

- SYSTEM SENSOR FAIL
- SYSTEM COMM FAIL
- SYSTEM MAINTENANCE

In all cases, both 4-20 mA signals (AO1 and AO2) will indicate with NE-43 alarm low or high, and the values of the process variables (flow, velocity, temperature) will be set to NOT_A_ NUMBER (9,876,543).

Channel Kickout

There are several faults that can cause a flow sensor channel to be kicked out of the average.

A flow sensor channel is kicked out of the average if its status error code from the Modbus query is non-zero. A non-zero status error code indicates there is a problem with the channel's flow sensor. The status error code for the channel can be viewed on the Channel Detail (Display mode, Option 5). The channel's velocity unit can be changed using KzComm and the RS-485 service ports on the Series 255 main board.

A channel is kicked out if its engineering unit is not in metric (SI units). When the Series 255 powers up it requests configuration information from each of the flow sensing channels including the velocity and temperature engineering units. This information is also requested when a channel is placed ONLINE. If the velocity unit is not NMPS, the Series 255 kicks out the channel from the average. A channel's unit configuration can be viewed on the Channel Detail (Display mode, Option 5).

A communication fault on a flow channel occurs if the flow sensor does not respond to Series 255 Modbus commands or if the response packet is not readable. The communication fault causes the flow channel data to be kicked out of the average. When a communication fault occurs, the Series 255 does not perform a retry on a flow sensor but will continue to send cyclic commands. The channel's communication status can be viewed on the Channel Detail (Display mode, Option 5).

Note If a flow sensor is not responding, it should be placed OFFLINE. It will cause the total communication cycle time to be longer.

NAMUR NE-107

Namur NE-107 provides a status signal that summarizes the health of the device. Table 3-3 shows the control panel event triggers that correspond to the NE-107 categories.

Table 3-3. Front Panel Status LEDs Description

Category	Description	Device Message/ Event
Normal (green, check mark)	System is normal, signal is valid.	NO EVENTS
Failed (red, X mark)	Signal is invalid due to a malfunction in the device, sensor, or actuator.	SYSTEM SENSOR FAIL SYSTEM COMM FAIL
Out of Specification (yellow, question mark)	Permissible ambient or process conditions exceeded, or the measuring uncertainty of sensors or deviations from the set value in actuators is probably greater than expected.	FLOW OUT OF RANGE TEMP OUT OF RANGE

Table 3-3. Front Panel Status LEDs Description

Category	Description	Device Message/ Event
Maintenance required (blue, oil can	Advisory. Although the signal is valid, the remaining life is nearly exhausted or a function will soon be restricted due to operational conditions.	CHANNEL KICKOUT ELECT TEMP HI
Check Function (amber/orange, wrench)	Signal temporarily invalid due to on-going work on the device.	SYSTEM MAINTENANCE ZERO-MID-SPAN TEST IS ACTIVE

The Series 255 Flow Averaging Transmitter uses easy to understand NAMUR NE-107-compliant colored status indicators on the front panel for five primary device diagnostic categories including System Normal, when there are no events active on the system. The status indicators are color coded according to the NE-107 recommendations.

Data Quality Status Byte

Each of the process variables provided by the Flow Averaging Transmitter (flow, velocity, temperature) have a corresponding data quality status that indicates:

- GOOD = the value is useful
- UNCERTAIN = the quality of the value is suspect
- BAD = the value is not useful

The data quality status is passed through to fieldbus protocols that support this additional process variable information.

Series 255 Main Board Overview

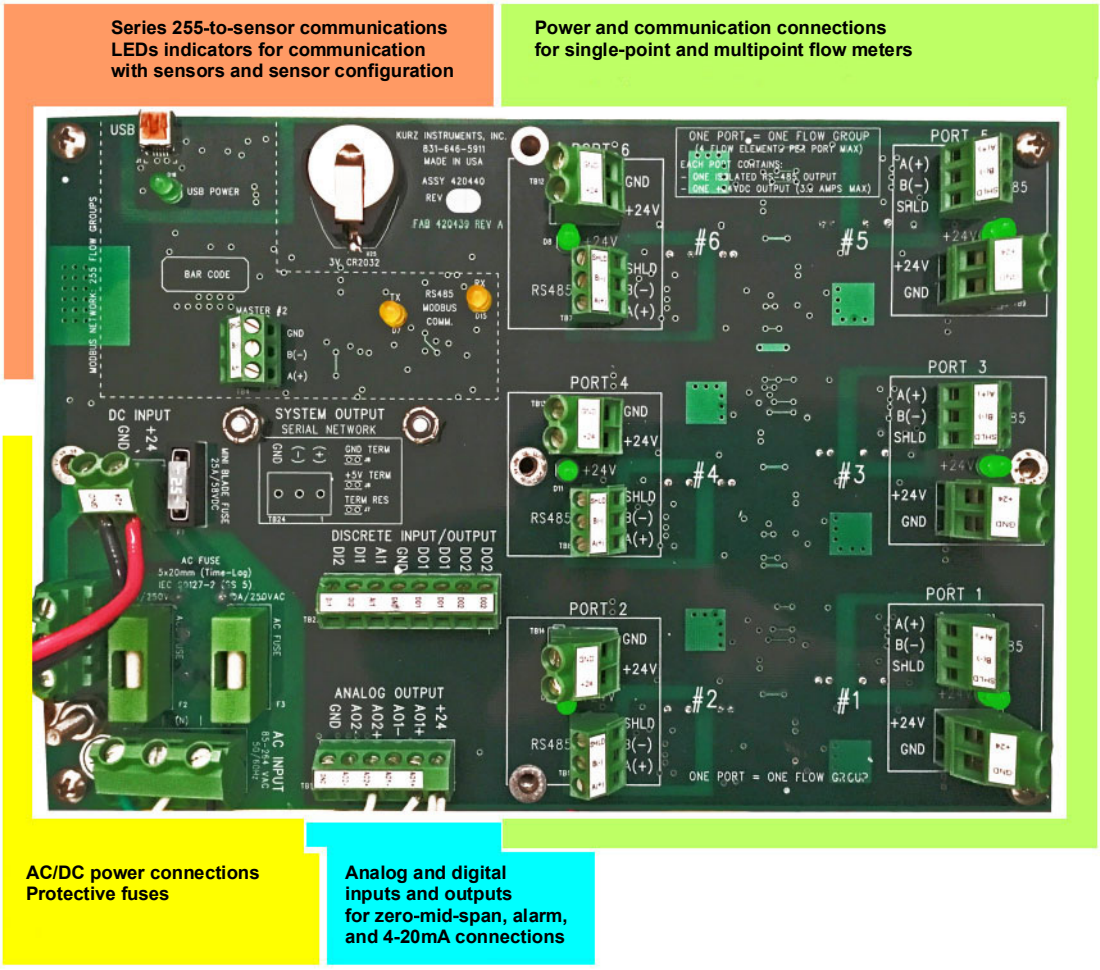


Figure 3-1. Series 255 Motherboard Overview

AC Power Connections

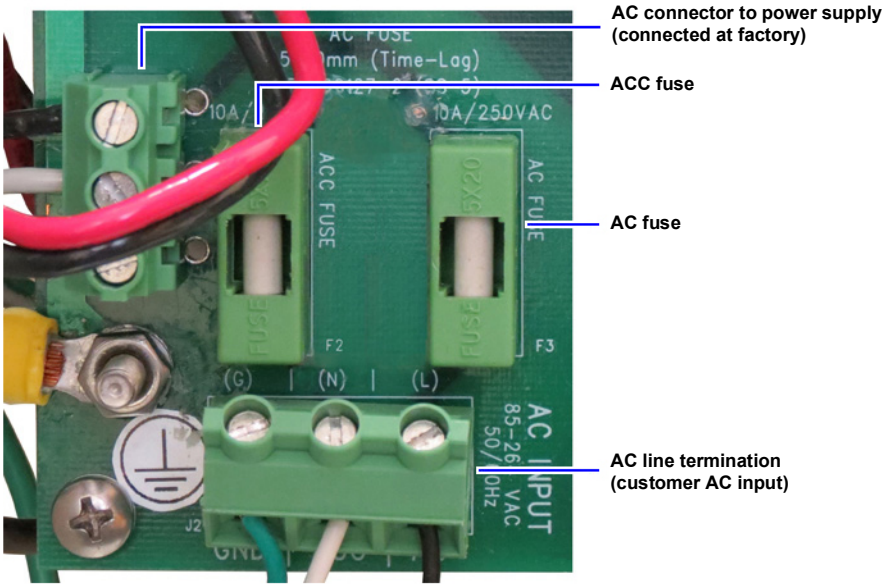


Figure 3-2. AC Power Connections

DC Power Connections

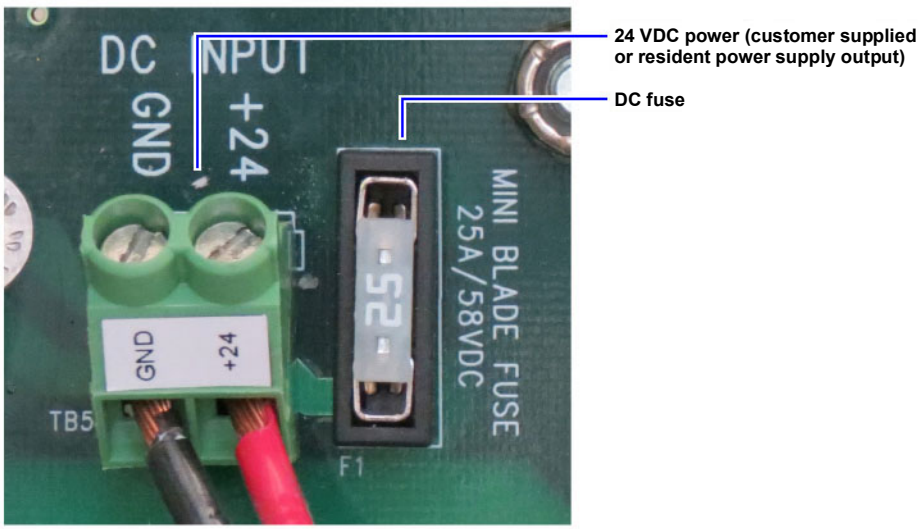


Figure 3-3. DC Power Connections

System Input and Output Communications

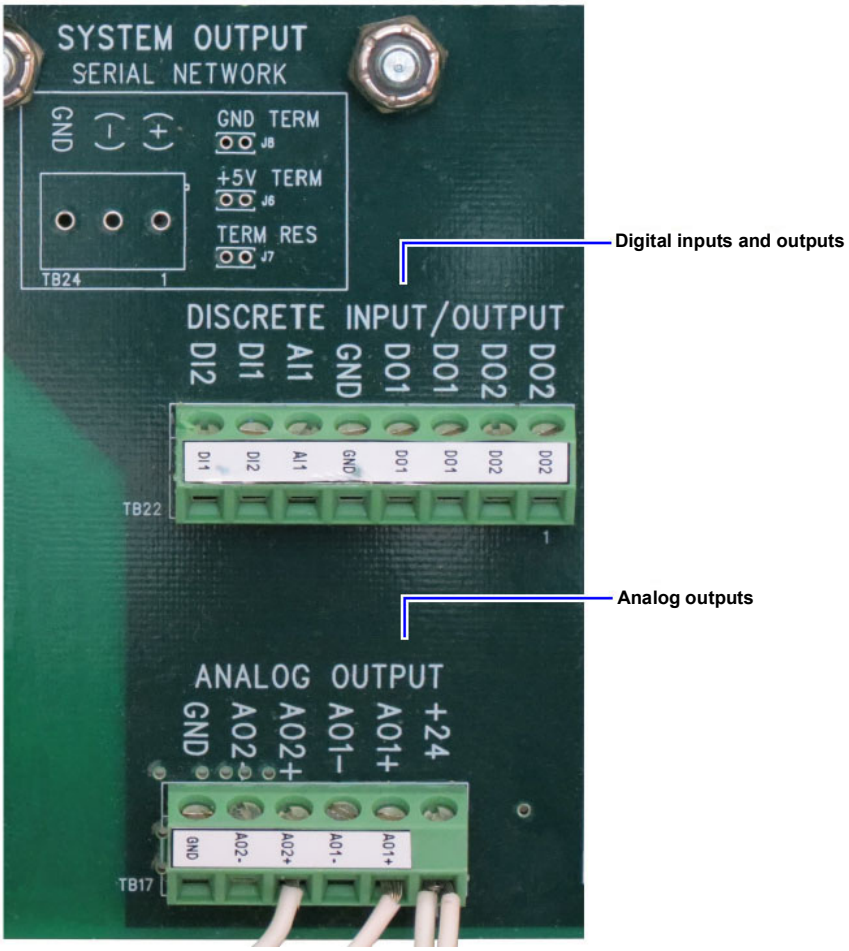


Figure 3-4. System Input and Output Communications

System Communications Area

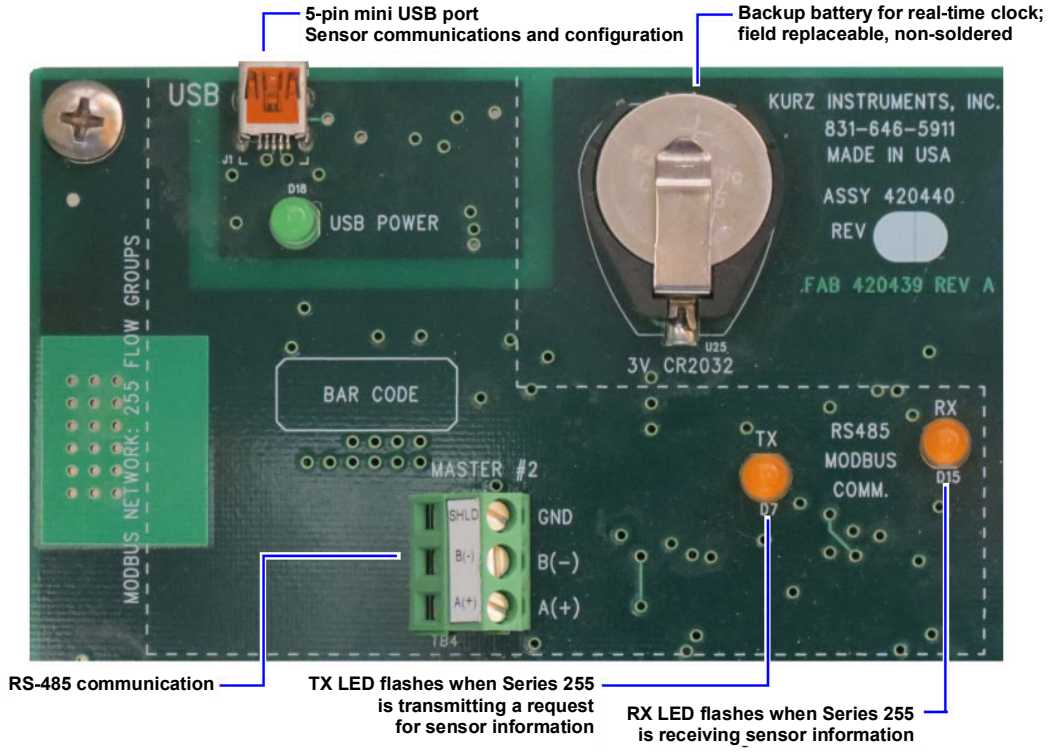


Figure 3-5. System Communications Area

Sensor Power and Communications Connections

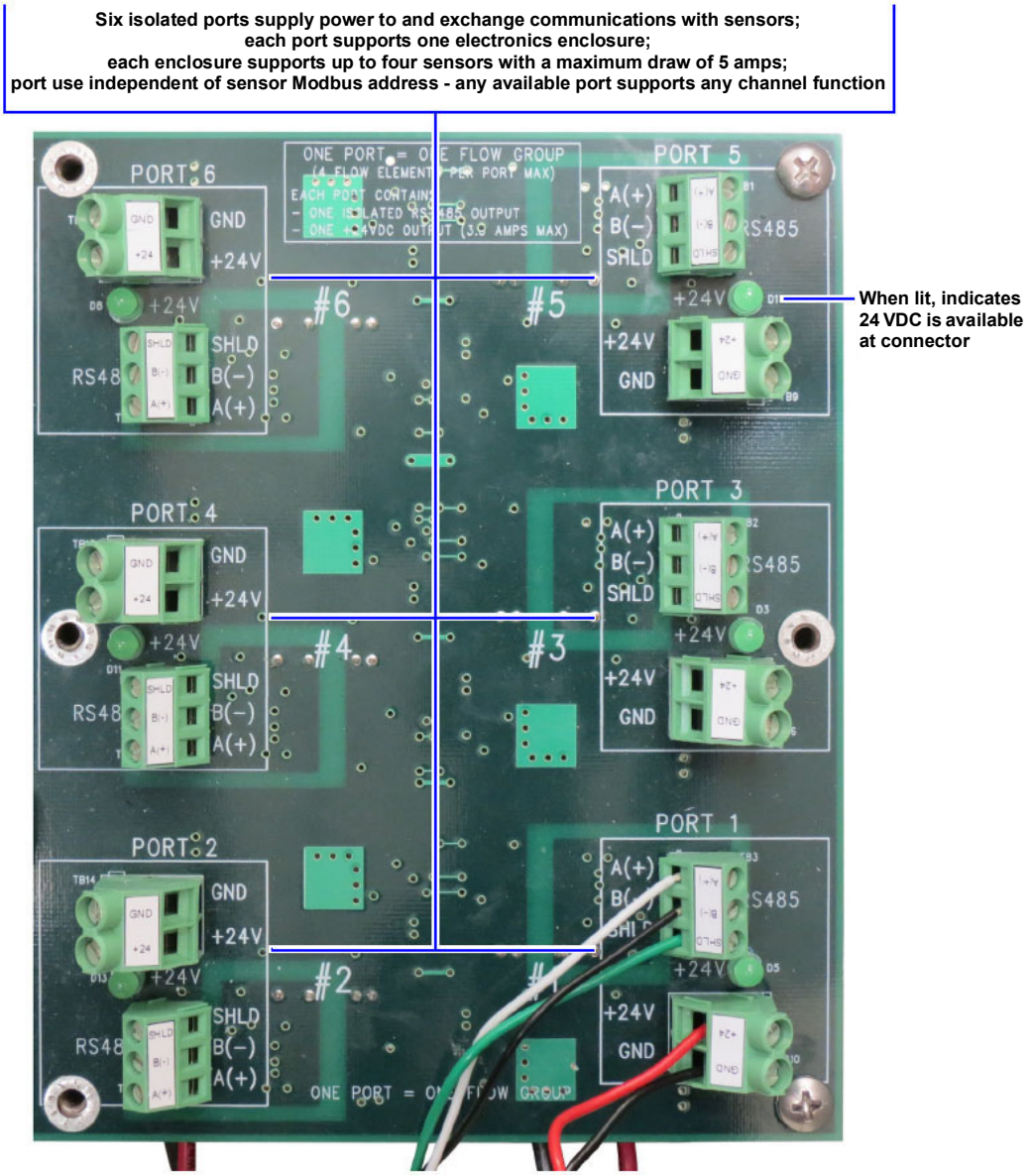


Figure 3-6. Sensor Power and Communications Connections

Troubleshooting

This section provides troubleshooting suggestions for the most common operating problems.

Procedures and instructions in this section may require special precautions to ensure the safety of the personnel performing the operations. Refer to the following safety messages before performing an operation preceded by this symbol.

Safety Requirements

Warning ***Failure to follow safe installation and servicing guidelines could result in death or serious injury.***

Make sure only qualified personnel perform the installation.

Use the equipment only as specified in the guide. Failure to do so may impair the protection provided by the equipment.

Do not perform and service other than those contained in the s guide unless you are qualified.

High voltage that may be present on leads could cause electrical shock.

Avoid contact with leads and terminals.

Make sure the main power to Series 255 is off and the lines to any other external power source are disconnected or not powered while wiring the Series 255.

Caution ***Make sure that there is no water or snow on top of the Series 255 when it is opened. This may damage the electronics inside the housing.***

Be careful when opening the cover in very low temperatures. High humidity and temperatures far below the freezing point may cause the gasket to get stuck in the cover. In that case you may use a heating fan to warm the housing in order to release the gasket. Be careful not to use excess heat, which may damage the housing and the electronics.

Channel Kickout

The Series 255 shows a CHANNEL KICKOUT event if any of the active flow sensor channels are kicked out of the average. When this event is active, the MAINTENANCE REQUIRED front panel status indicator illuminates. There are several reasons a flow sensor channel can be kicked out of the average.

- A flow sensor channel is kicked out of the average when its status error code is non-zero.
  A non-zero status error code indicates there is a problem with the channel's flow sensor.
  The Channel Detail is available in Display mode, Option 5.
  The status error code appears in the top right-hand corner of the Channel Detail.

```
CHF TEST-001 0000          <----- Status code is zero = Good
VEL 2.2 NMPS ONL
TEMP 20.0 DEGC INC
```

```
CHJ KURZ MFT 4025          <----- Status code is non-zero = Error
VEL 0.0 NMPS ONL
TEMP ****** DEGC INC
```

- A flow sensor channel is kicked out if the measurement units are not metric (SI units).
  During power up the Series 255 requests configuration information from each flow sensing channel, including the velocity and temperature engineering units. This information is also requested when a channel is placed ONLINE. If the velocity unit is not NMPS (or UNKNOWN), the Series 255 kicks out the channel from the average. The Channel Detail is available in Display mode, Option 5.

```
CHD 3F253-RT 0000
VEL 34.3 SFPM ONL          <----- English velocity units
TEMP 68.0 DEGF INC         <----- English temperature units
```

- A communication fault causes a flow channel data to be kicked out of the average.
  A communication fault on a flow channel occurs if the flow sensor does not respond to Series 255 Modbus commands or if the response packet is not readable. When a communication fault occurs, the Series 255 does not perform a retry on a flow sensor but will continue to send cyclic commands. The Channel Summary that shows each channel's communication status is available in Display mode, Option 4.

```
CH  ABCDEF             <----- Channel D is indicating a
COM YYY-YY             <----- COM failure and is
KO  ---Y--             <----- Kicked out
```

Note A flow sensor that is not responding should be placed OFFLINE.
A communication failure for a channel that is not kicked out causes the total communication cycle time to be longer.

- A flow channel data is kicked out of the average if the channel velocity value is negative. This can occur when the flow sensor's Modbus configuration is not compatible with the Series 255 Modbus configuration (referred to the "endianness" of the flow channel data). This information is configured as REGISTER ORDER on the flow meter's Modbus configuration, while the Series 255 is expecting the REGISTER ORDER to be BYTE #12 34.

The multipoint flow sensor array degrades in accuracy as sensors in the array drop out. The flow reading calculated by the Series 255 can go up or down, depending on which sensors in the array drop out and the dynamic profile at the current flow rate. The best corrective action is to fix or replace the kicked out sensor.

Modbus Communication Between the Series 255 and the Flow Sensors

The Series 255 communicates to the flow sensor channels using the Modbus protocol over RS-485. If the Series 255 is not able to communicate with a flow sensor channel, the channel's process measurement is kicked out of the average. A flow sensor kicked out of the average may affect the accuracy of the flow measurement.

The Modbus protocol is a messaging structure that allows a Master device to communicate with Slave devices. Modbus communication allows only one Master device talking to one or more Slave devices. Each Slave has a unique address. Poll-response type of messaging requires the Master device initiates a message, and each Slave device remains quiet until receiving an address-specific message.

Some tips to troubleshoot the Series 255 flow sensor network:

- Never put two Modbus-RTU masters on the same network. The Modbus-RTU protocol allows only one Master. Adding a second Master will interfere with the operation of the network or completely prevent communications.
- To troubleshoot the communication network, the Series 255 must be put in Maintenance mode to use the RS-485 auxiliary ports on the main board that are used to communicate or troubleshoot the flow sensors.
- When possible, gradually create the network. Add flow devices one at a time and confirm the network is stable after each addition. In the event of any problem, debugging the network is easier in the event of a problem.
- The Series 255 and the flow sensors must be configured with the same baud rate. The default baud rate is 38400 bps for the Series 255 and the flow sensors. The highest baud rate may not be useful for your application. Slower baud rates can provide more efficient communication with lower error rates and fewer transmission errors. Distance between devices is also a factor, as long cables and high speeds do not always work well.
- Each flow sensor must be configured with a unique Modbus address. Duplicating an address can cause problems communicating with that address because two flow sensors will attempt to respond to commands at the same time.
- Avoid routing cables for communication with AC power cables. The 24V DC power cables can be routed with the RS-485 cables.

- The RS-485 connections between the Series 255 and the flow sensors are not polarity-sensitive. Reversed polarity is supported with B-Series Modbus communication. Reversing the RS-485(+) and RS-485(-) will not affect communication.
- The point-to-point wiring provided with your system indicates where the terminating resistor should be placed in the network. The terminating resistor in the Modbus wiring is usually placed on the last flow sensor on the Port string to signify the end of the line. When purchasing the Series 255 and flow sensors as a system, the terminating resistors are pre-installed on the required flow sensors. The terminating resistor should be a 120 Ohm resistor.
- When suspecting that a flow sensor is not communicating properly, change the sensor's physical position in relation to a flow sensor that is working properly. This can help determine if the problem is equipment-related (typically configuration) or position-related (typically cabling problem or noise).
- The LEDs on the main board provide valuable information on system operation. The Series 255 and the Kurz flow sensors have two LEDs that indicate sending (Tx) and receiving (Rx) Modbus transmissions. The LEDs flash accordingly when receiving and sending commands or responses. With the Series 255 LEDs, the flashes for the sending LED are closely followed by the receiving LED (indicating the response from the slave). The receiving LED typically flashes more frequently because of all the received commands, including commands sent to the other flow meters. The sending LED flashes only when sending a response, which occurs only when a command is addressed to a specific flow meter.
- The RS-485 network must use three wires. The third conductor serves as a ground or common reference signal against which the positive and negative wire voltage is measured. This helps avoid problems in communication due to a difference in potential from one location to another.

Appendix A

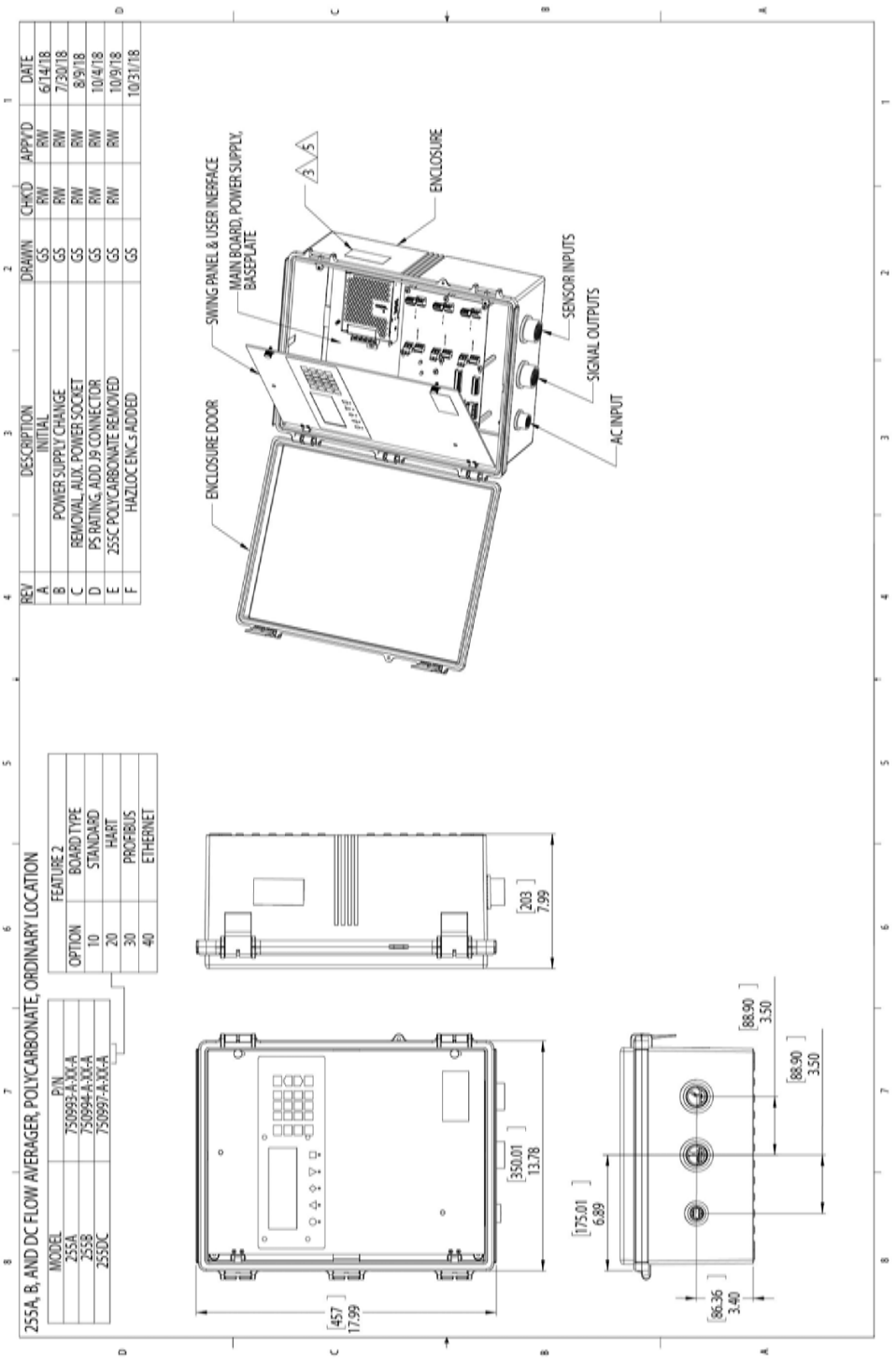
Drawings & Diagrams

Overview

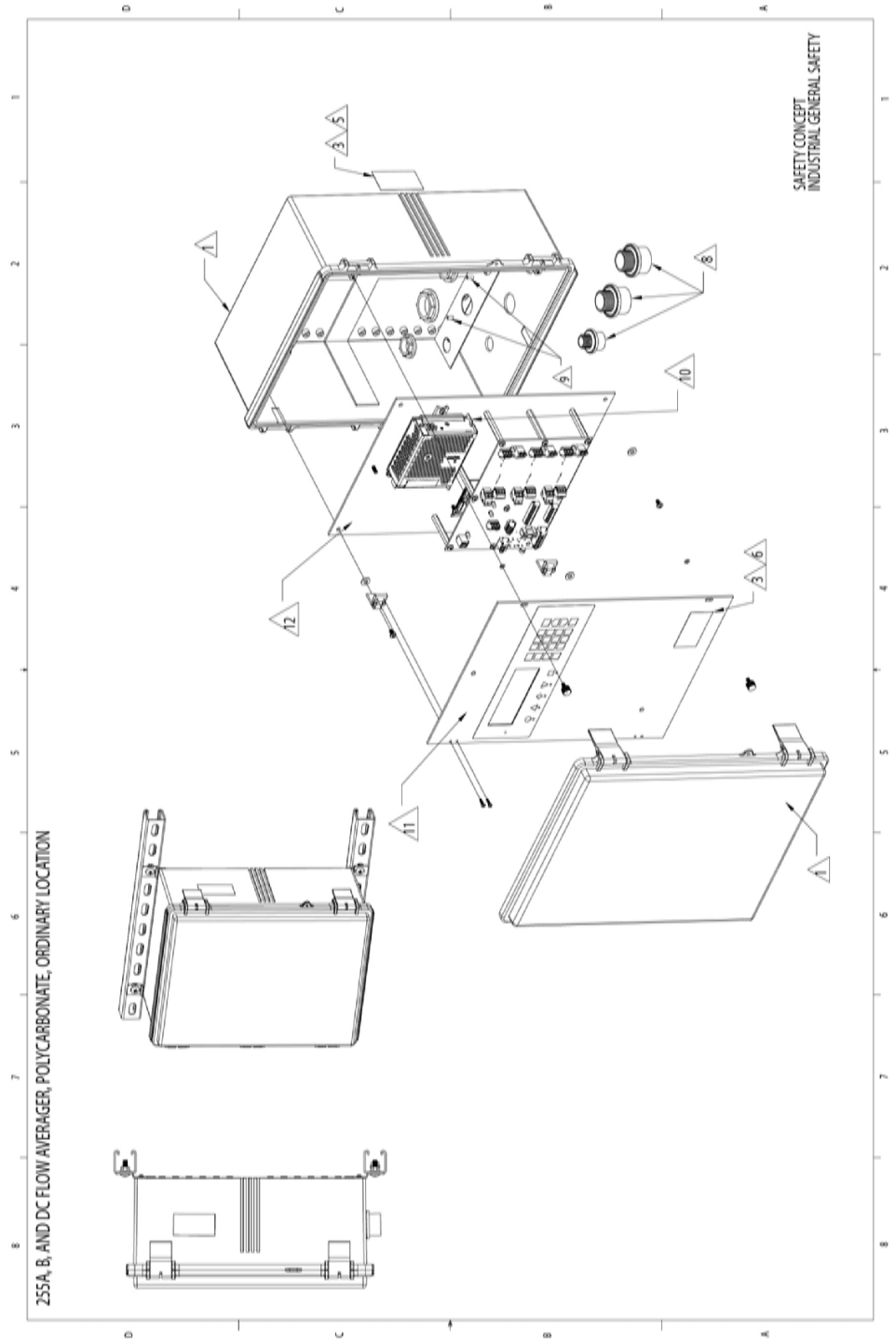
This appendix provides the drawings for the Kurz Series 255 product line. It includes:

- Models 255A, 255B, and 255DC, Polycarbonate, Ordinary Locations (1 of 2)
- Models 255A, 255B, and 255DC, Stainless Steel, Ordinary Locations
- Model 255C, Polycarbonate, Ordinary Locations (1 of 2)
- Model 255C, Stainless Steel, Ordinary Locations
- Model 255, Rack Mount, Ordinary Locations
- Models 255A, 255B, and 255DC, Stainless Steel, Hazardous Locations
- Series 255 Universal Swing Plate & Base Plate Subassemblies
- Series 255 Field Wiring Diagram (1 of 4)
- Series 255 Field Wiring to Flow Element (1 of 3)

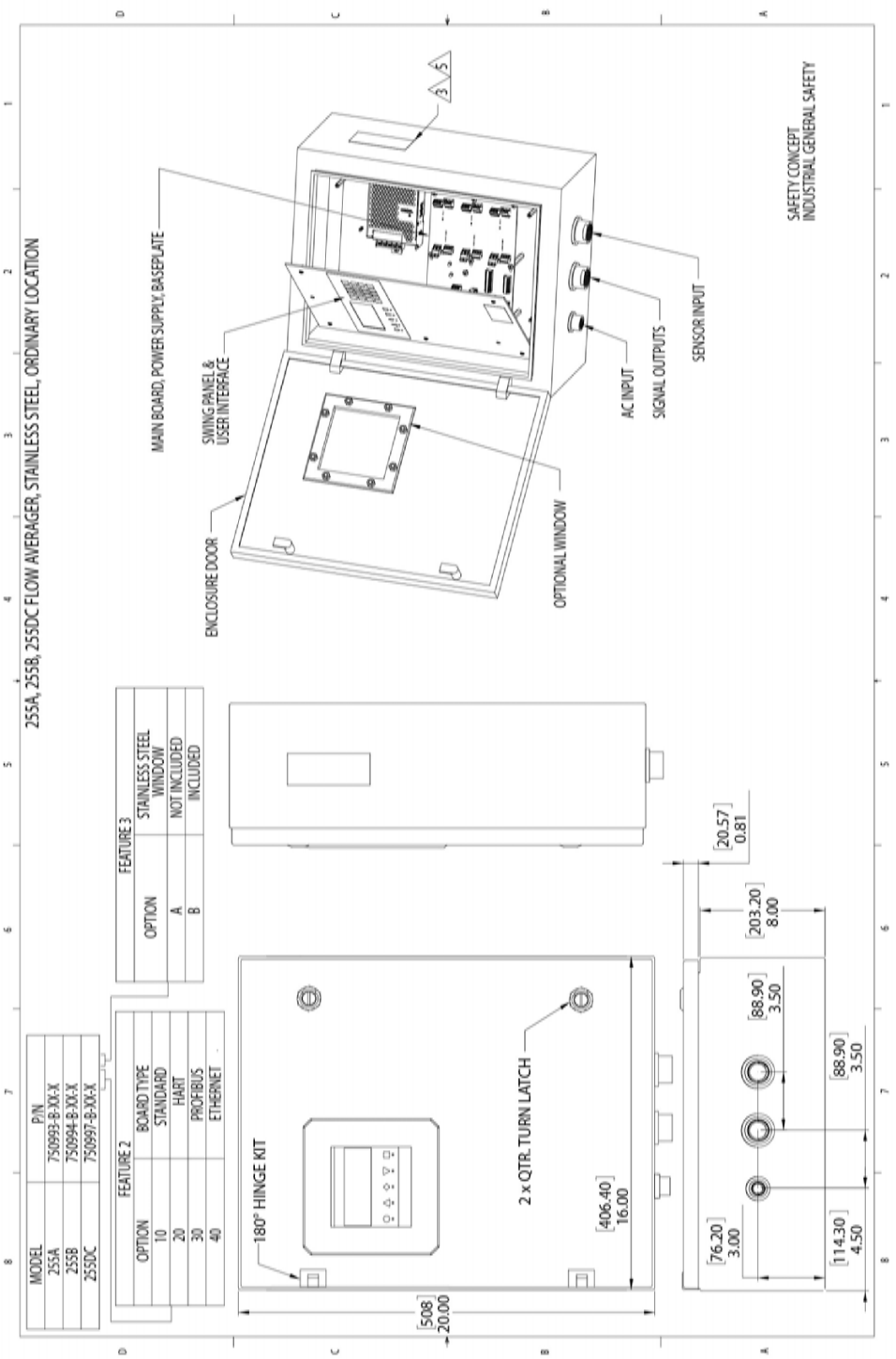
Models 255A, 255B, and 255DC, Polycarbonate, Ordinary Locations (1 of 2)



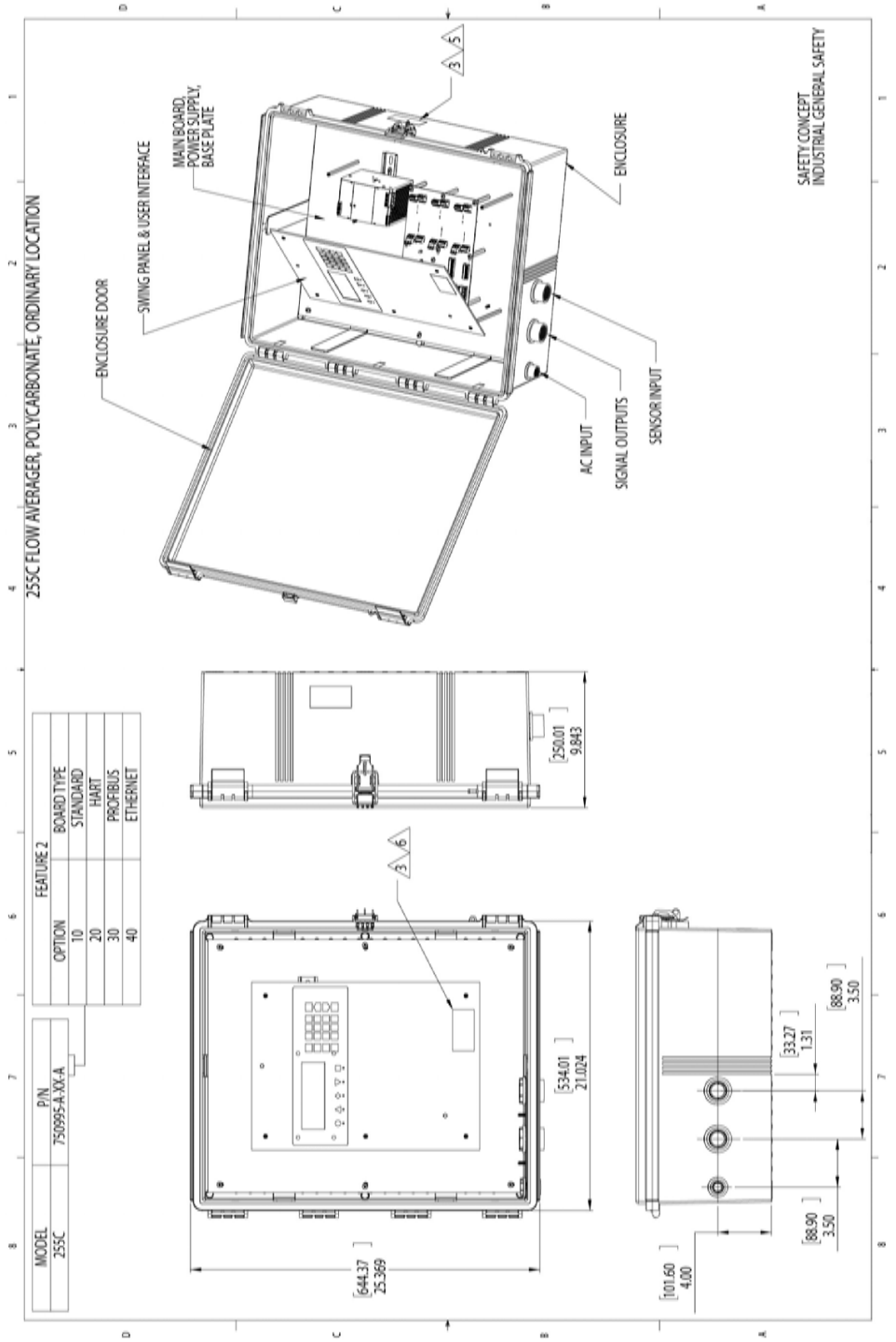
Models 255A, 255B, and 255DC, Polycarbonate, Ordinary Locations (2 of 2)



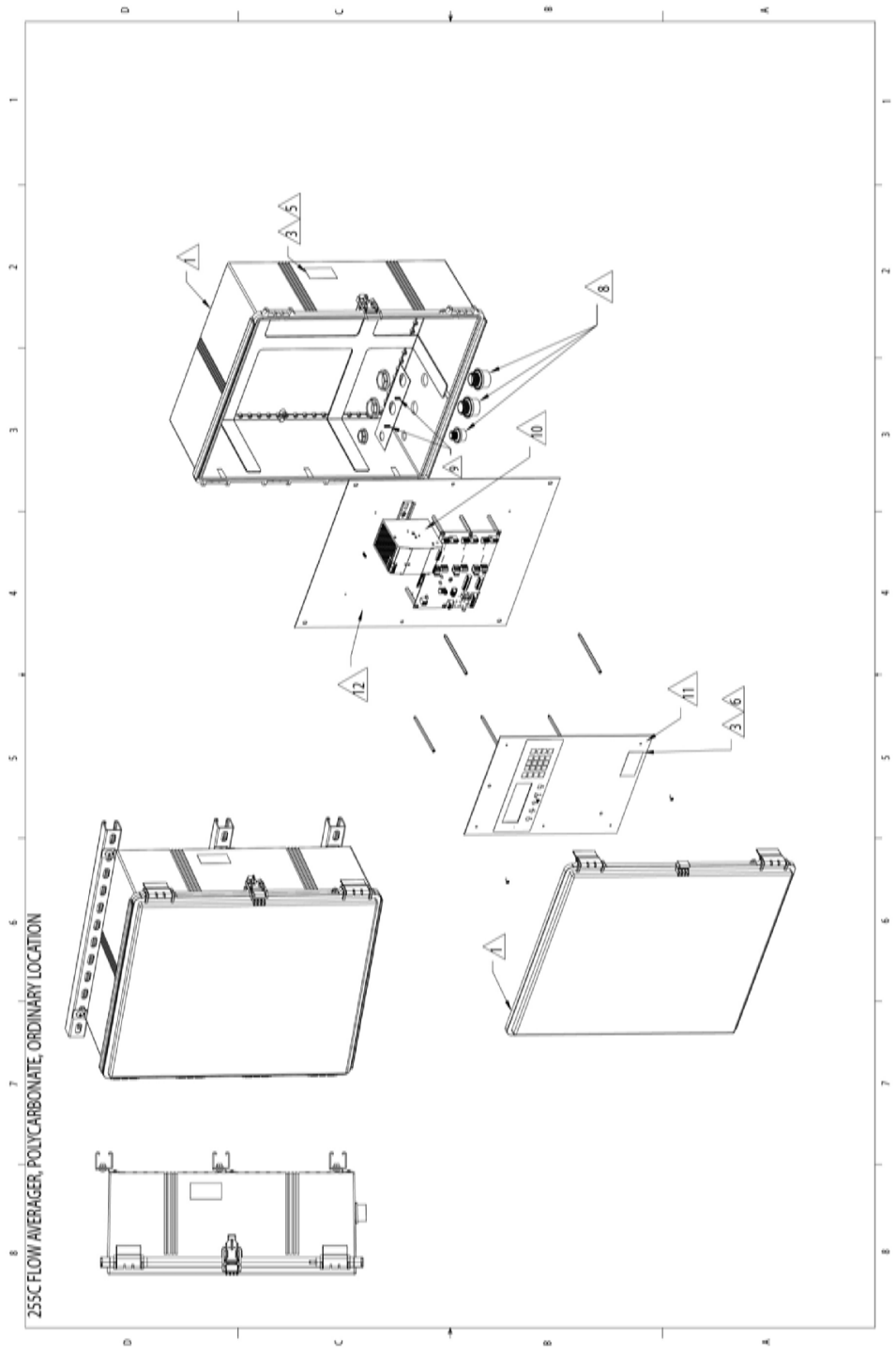
Models 255A, 255B, and 255DC, Stainless Steel, Ordinary Locations



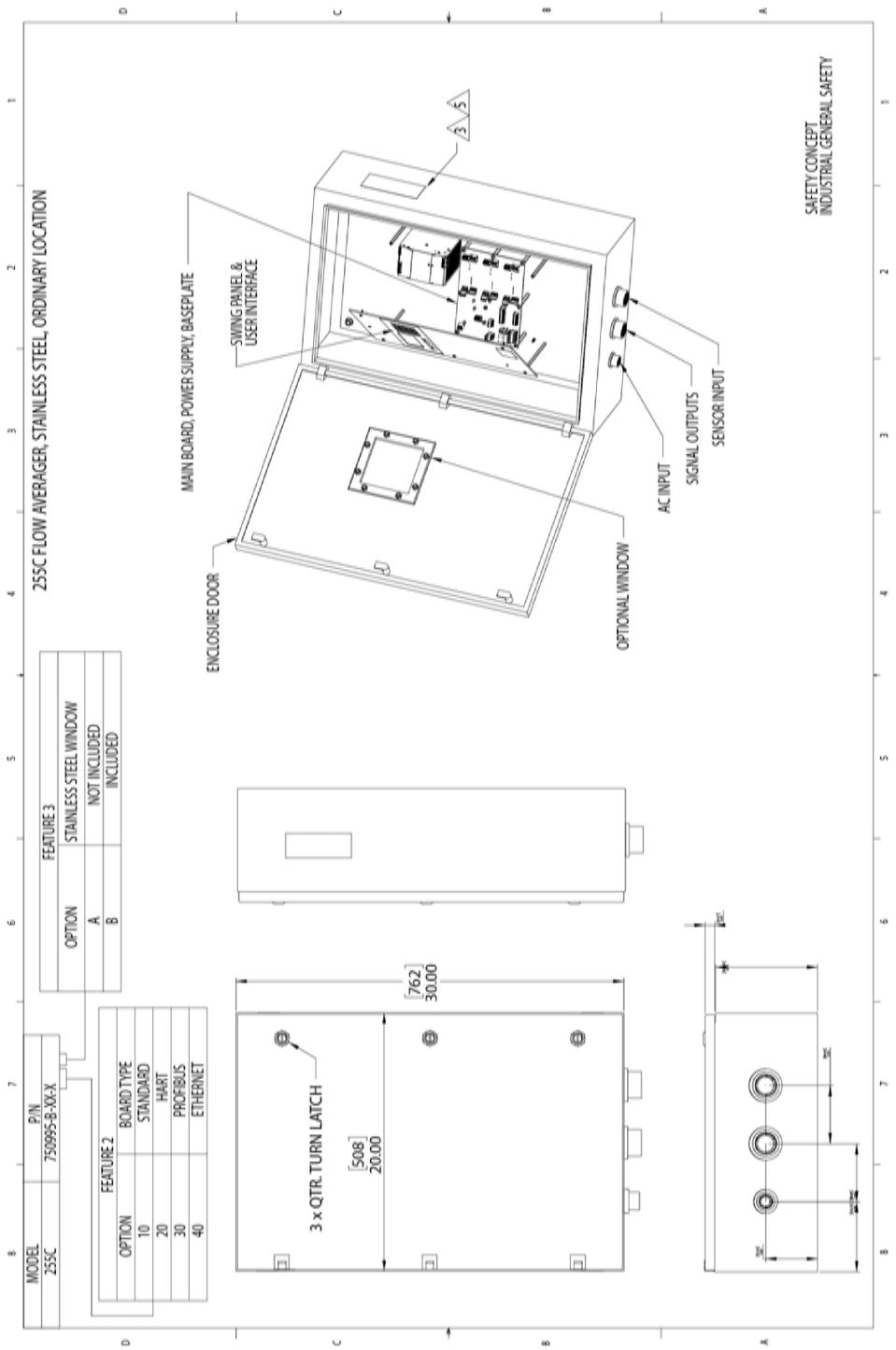
Model 255C, Polycarbonate, Ordinary Locations (1 of 2)



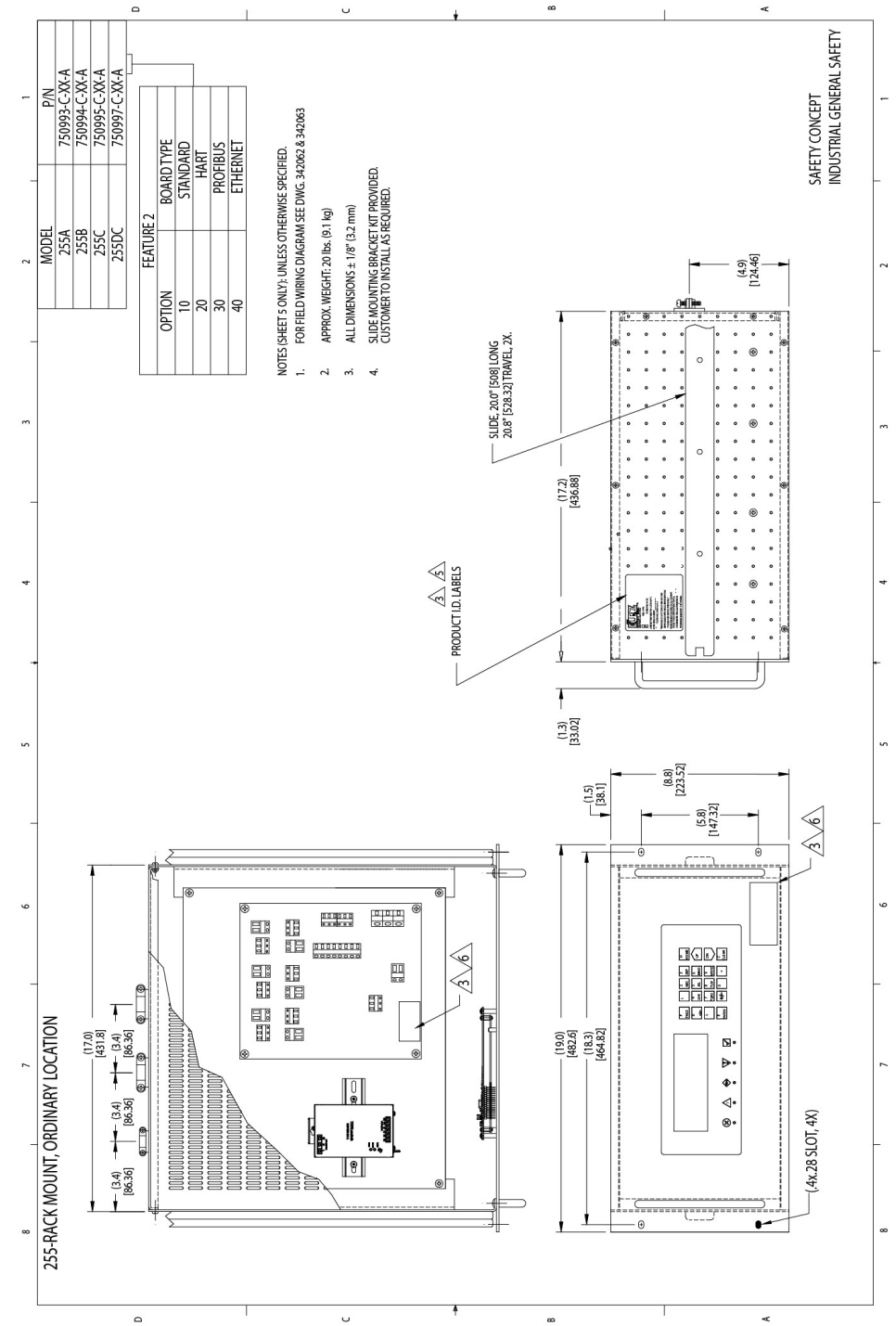
Model 255C, Polycarbonate, Ordinary Locations (2 of 2)



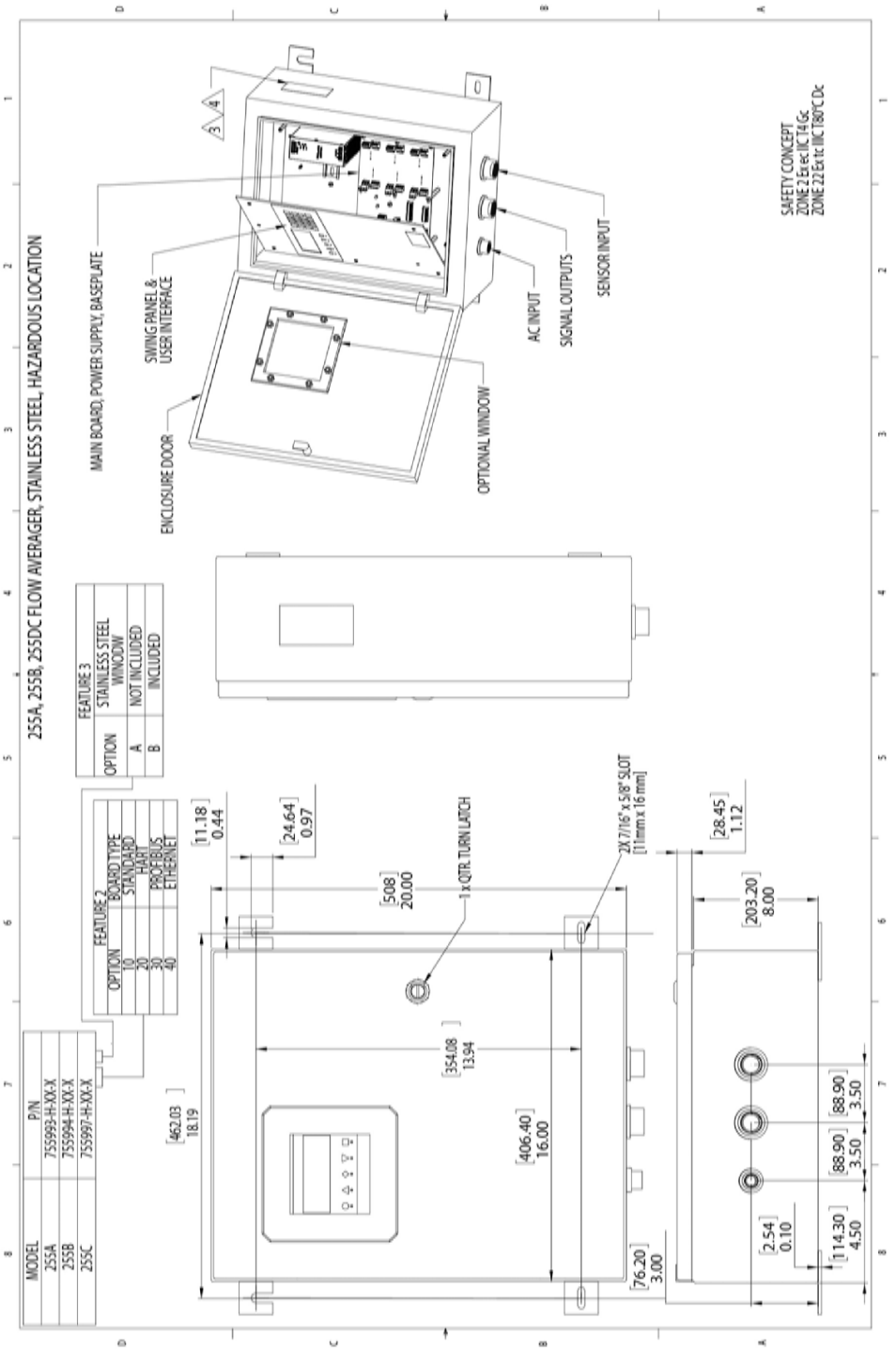
Model 255C, Stainless Steel, Ordinary Locations



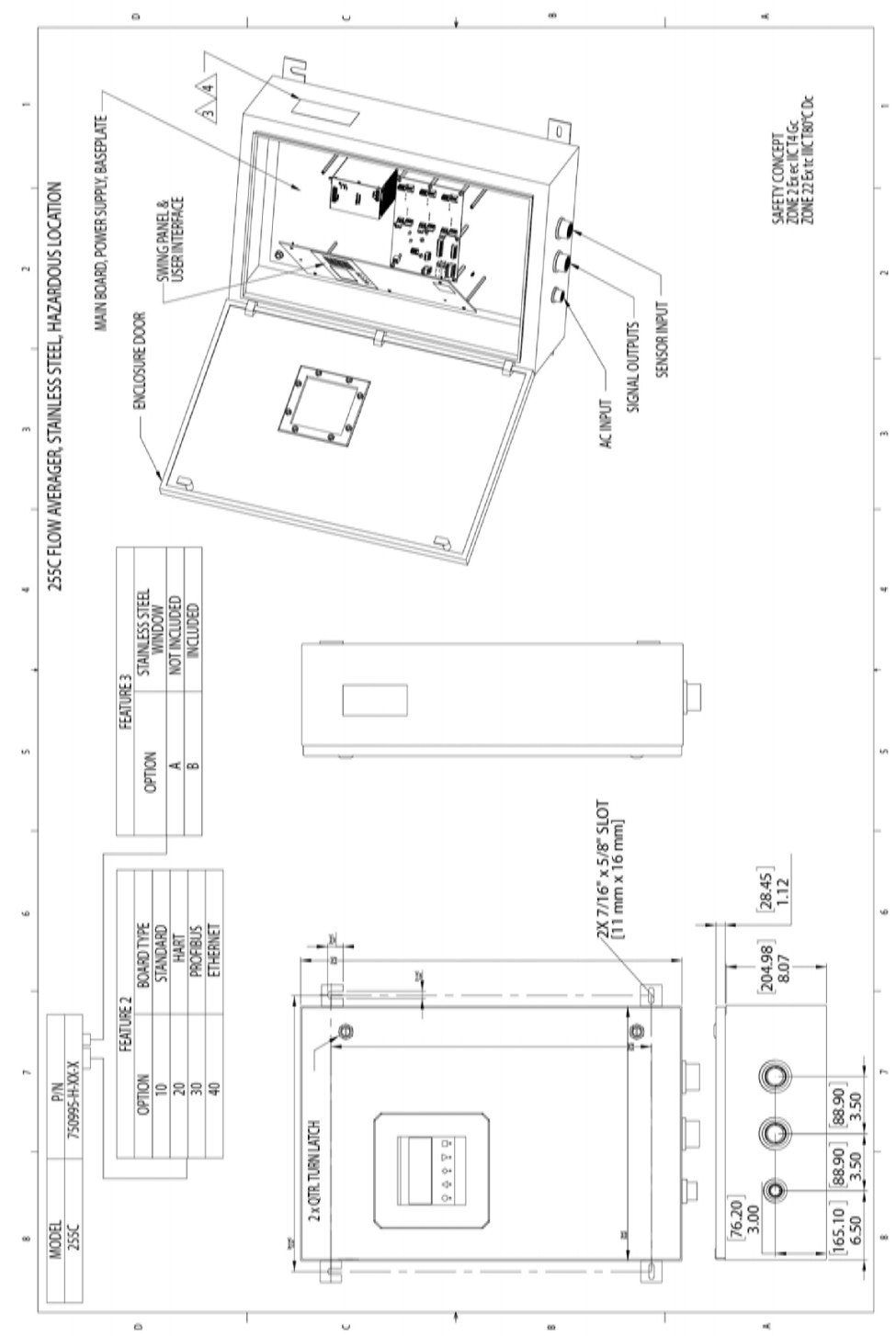
Model 255, Rack Mount, Ordinary Locations



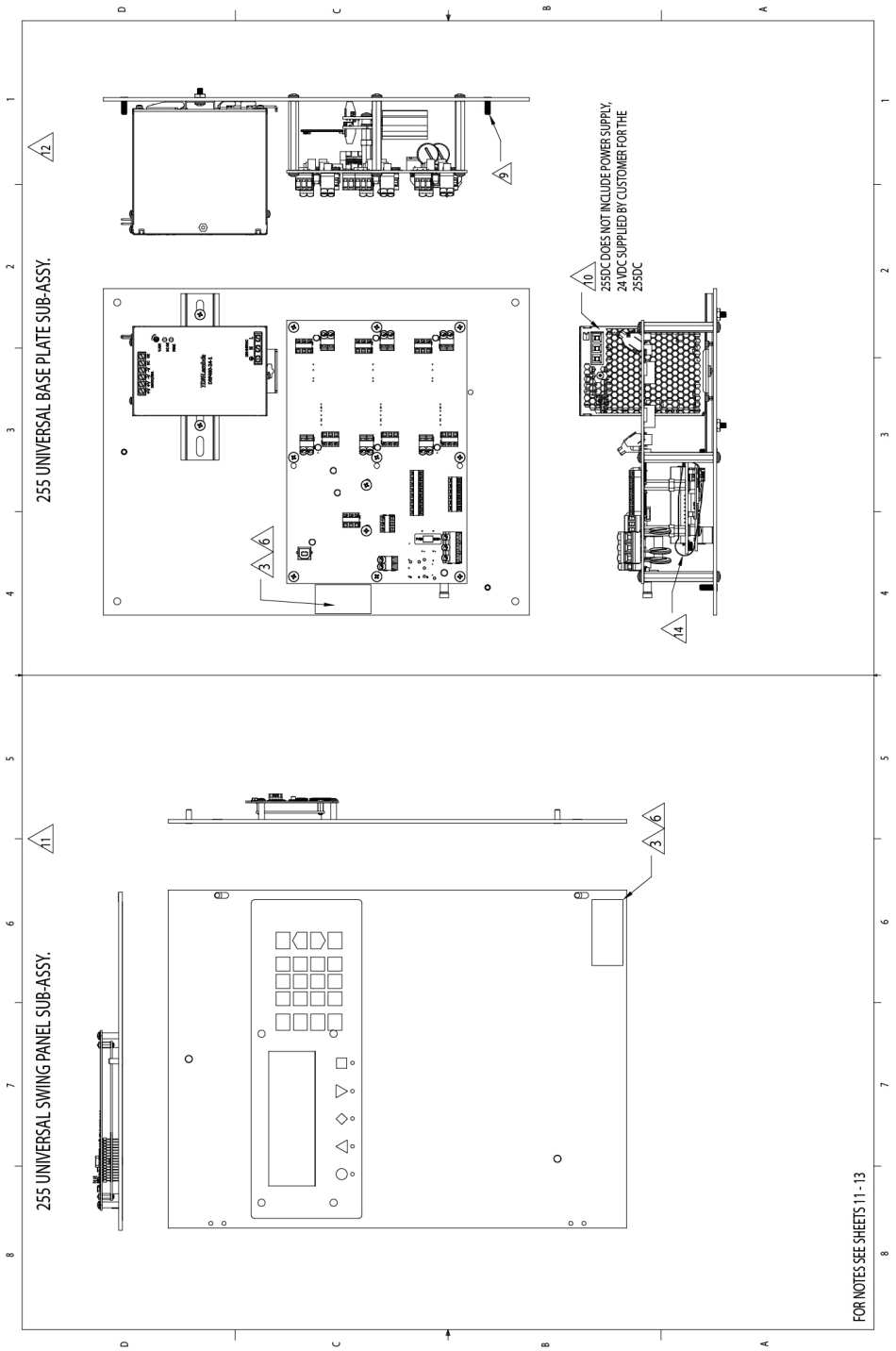
Models 255A, 255B, and 255DC, Stainless Steel, Hazardous Locations



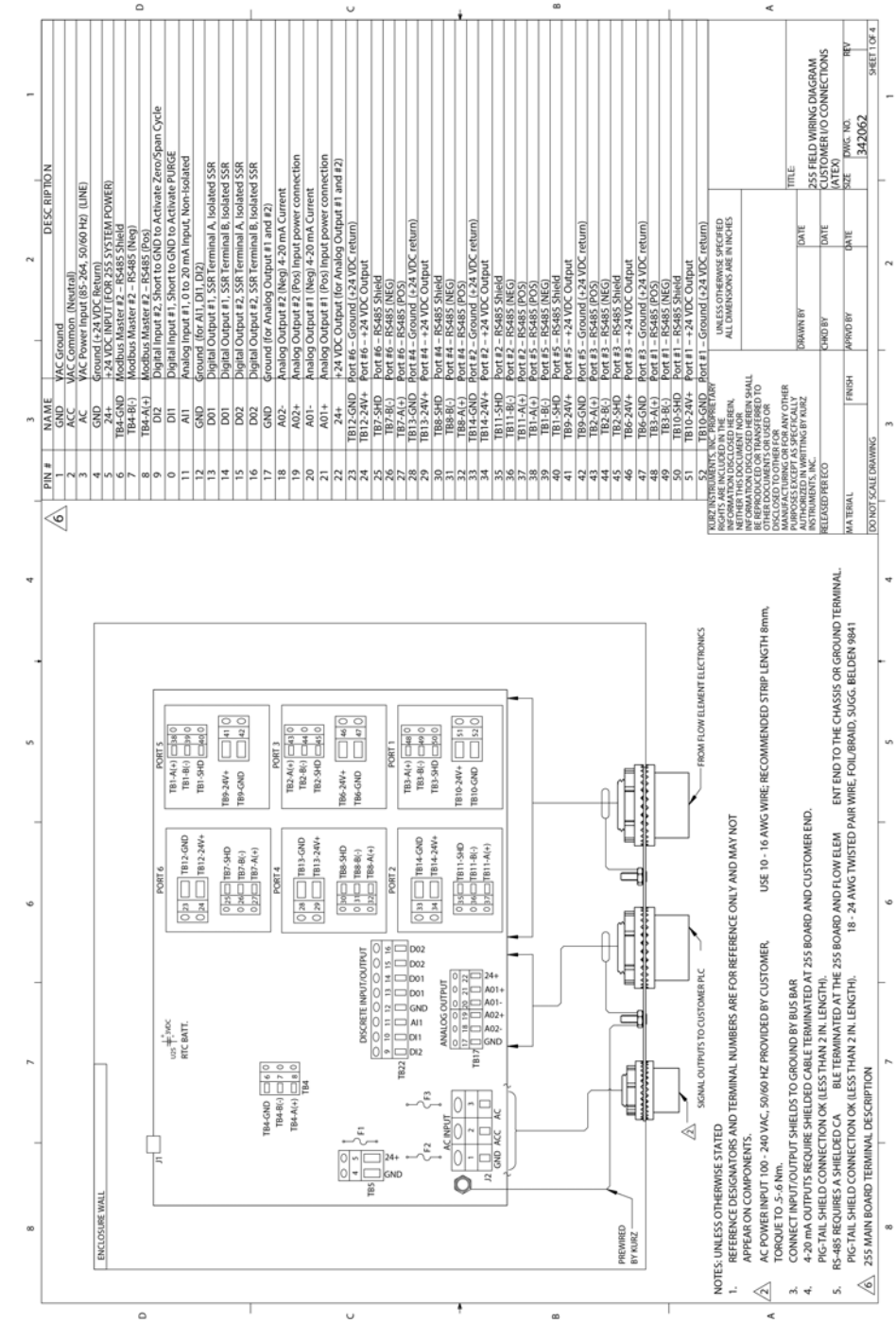
Model 255C, Stainless Steel, Hazardous Locations



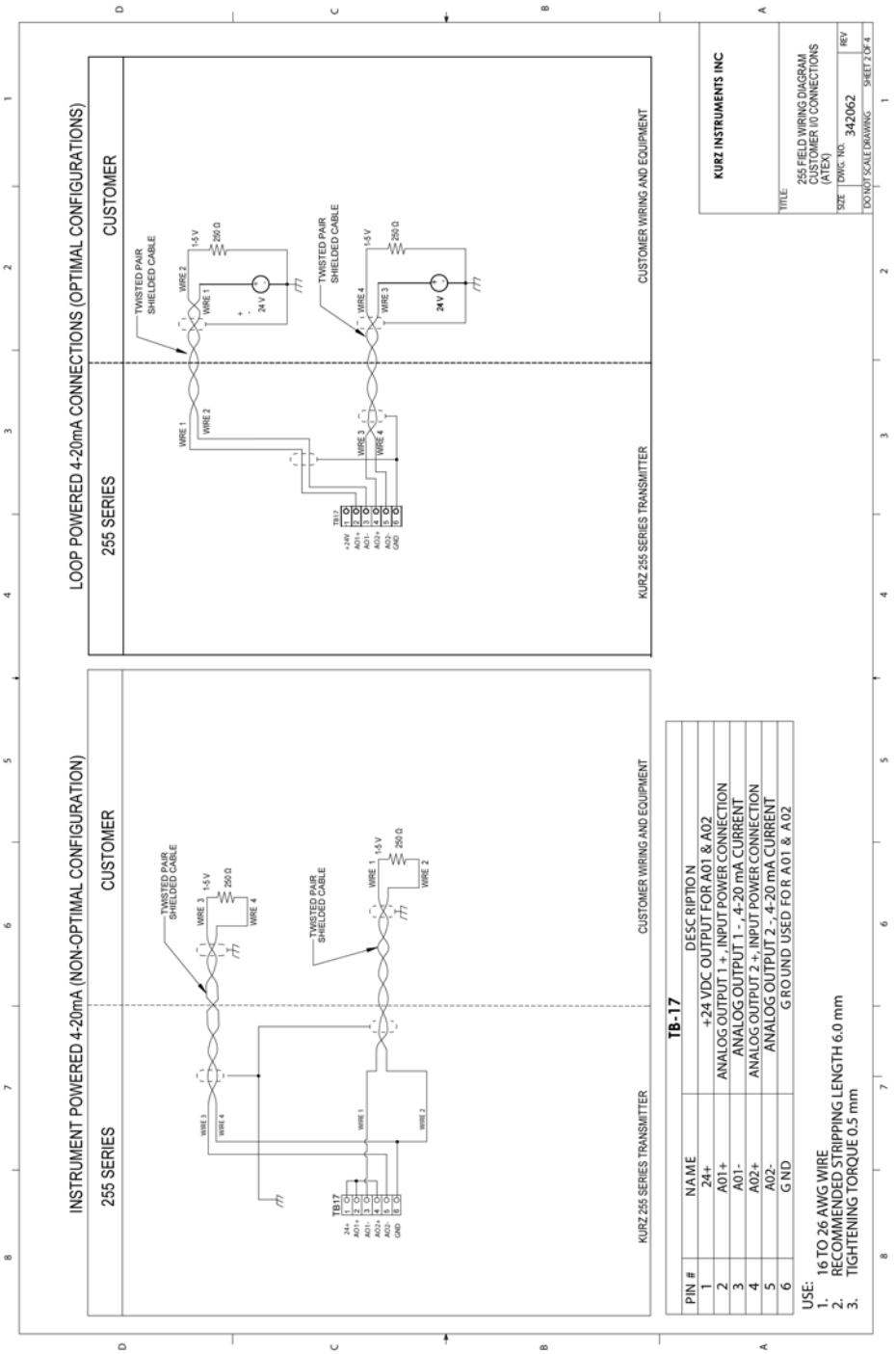
Series 255 Universal Swing Plate & Base Plate Subassemblies



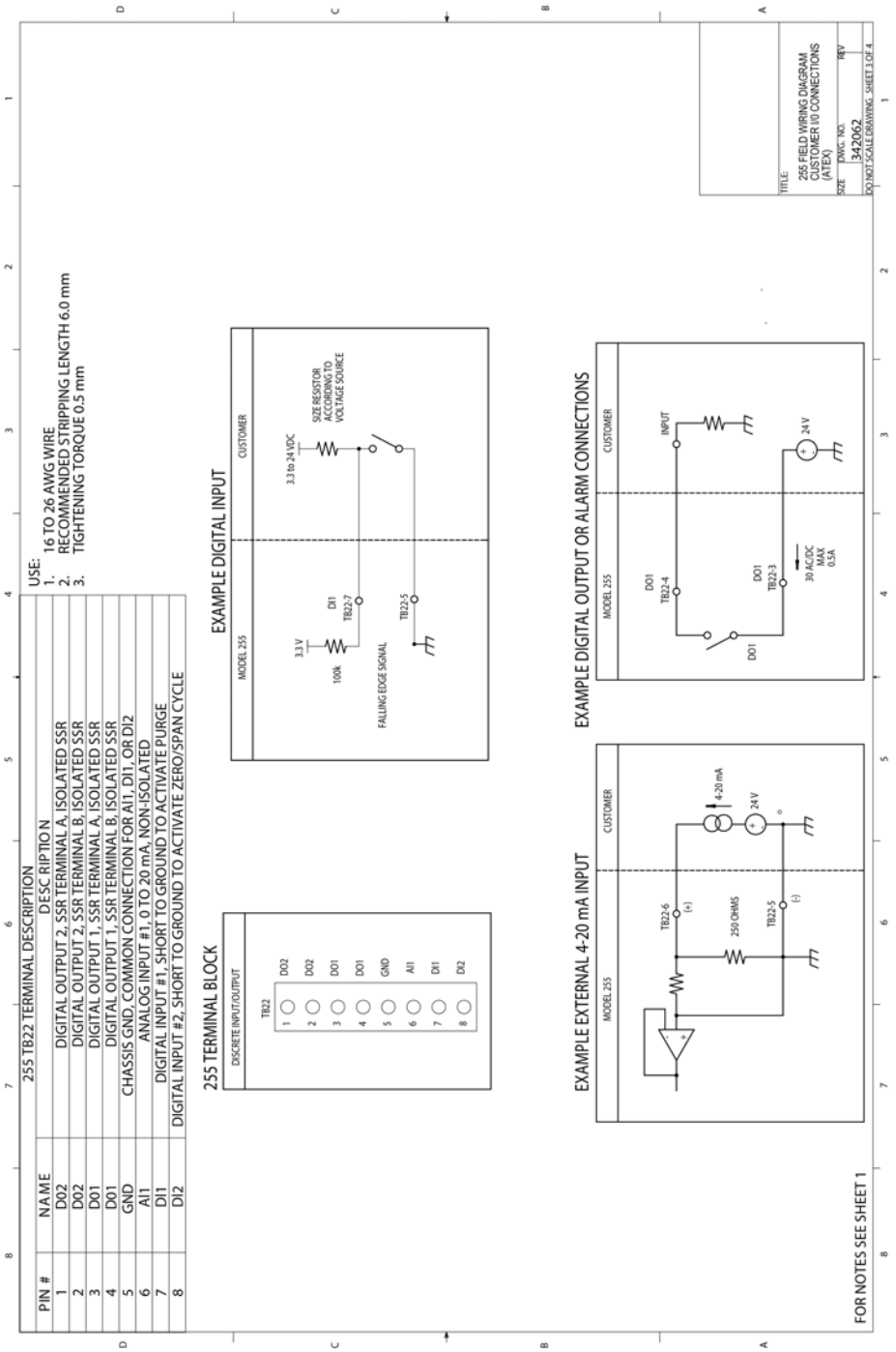
Series 255 Field Wiring Diagram (1 of 4)



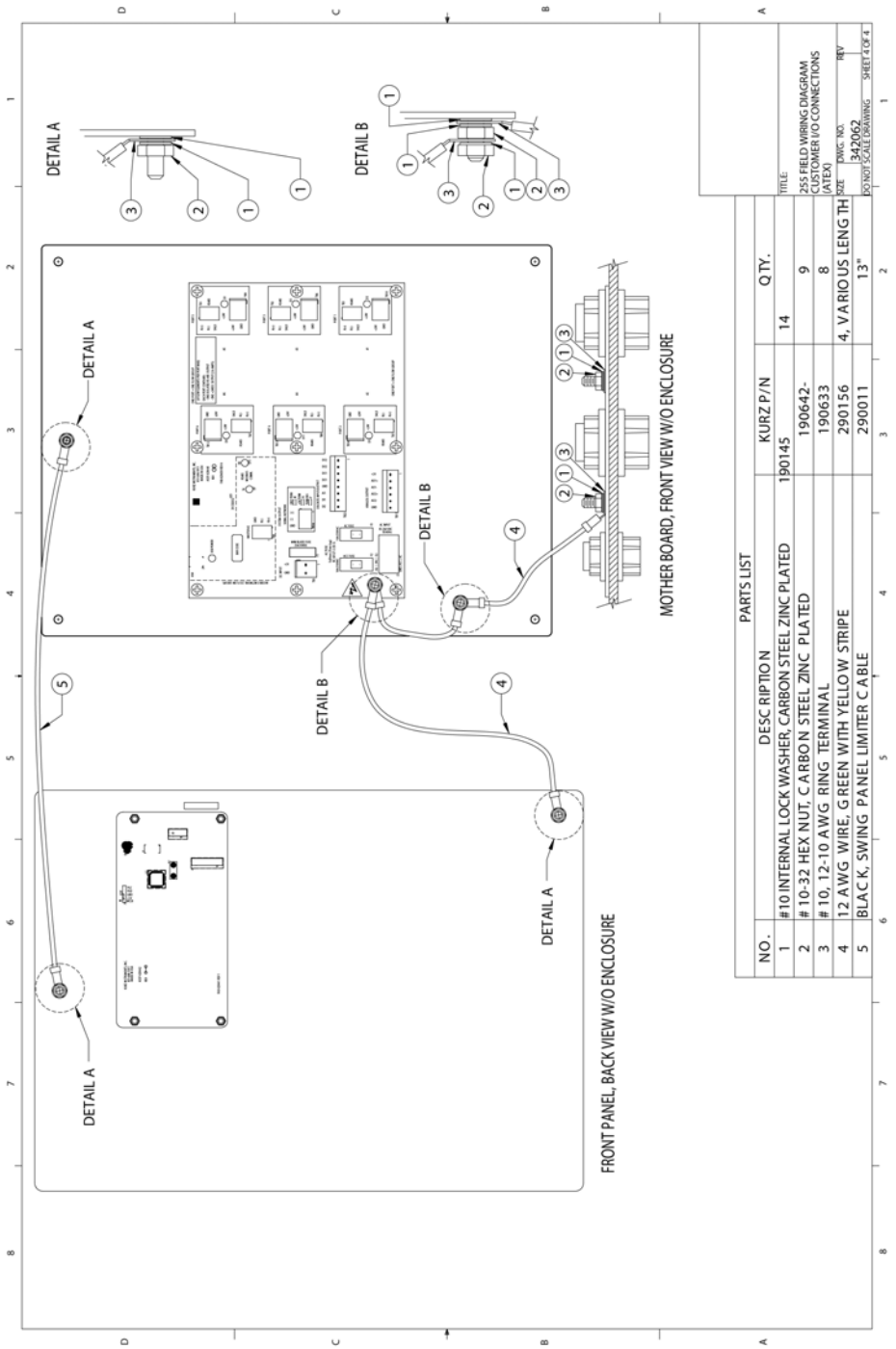
Series 255 Field Wiring Diagram (2 of 4)



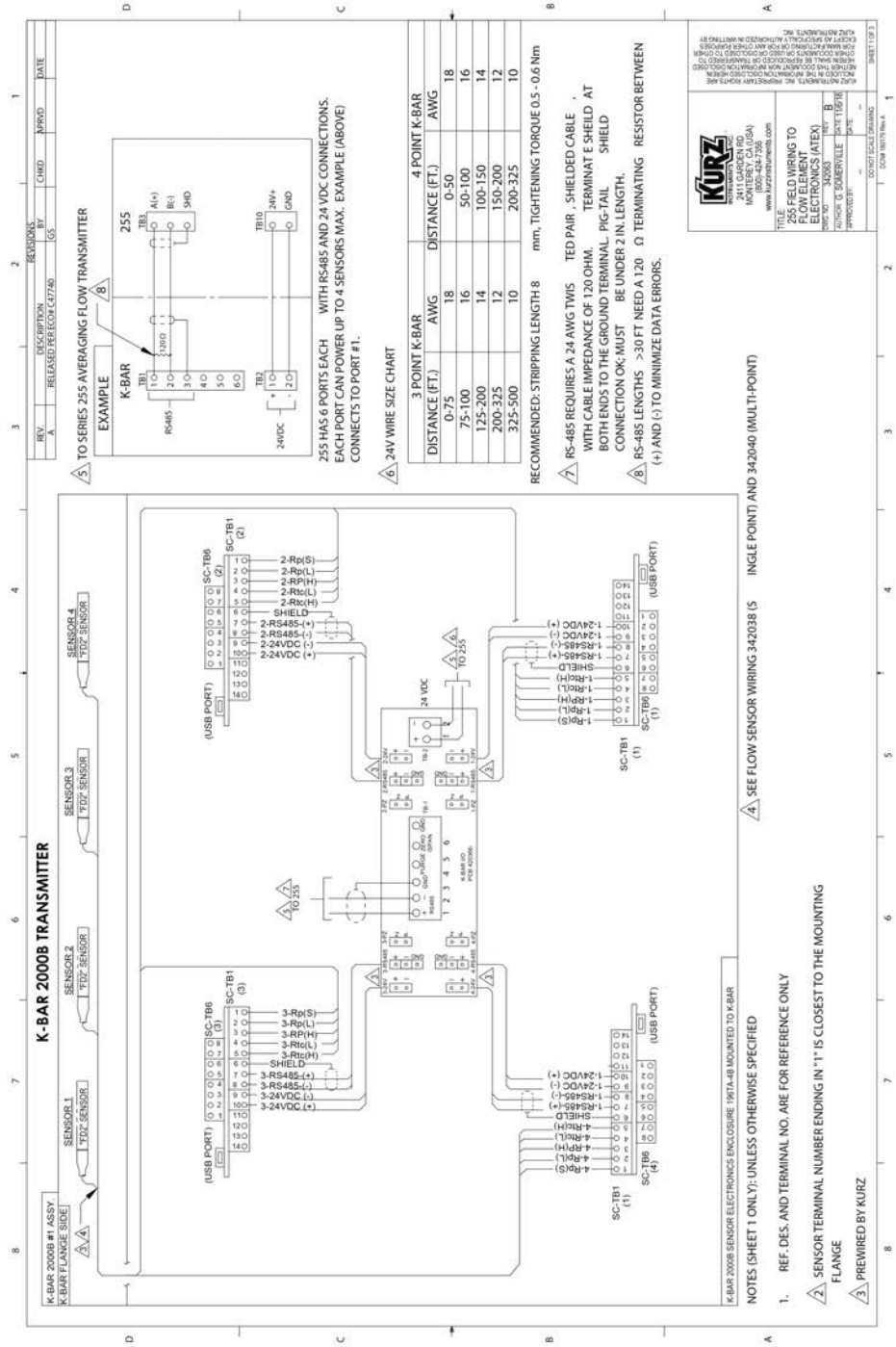
Series 255 Field Wiring Diagram (3 of 4)



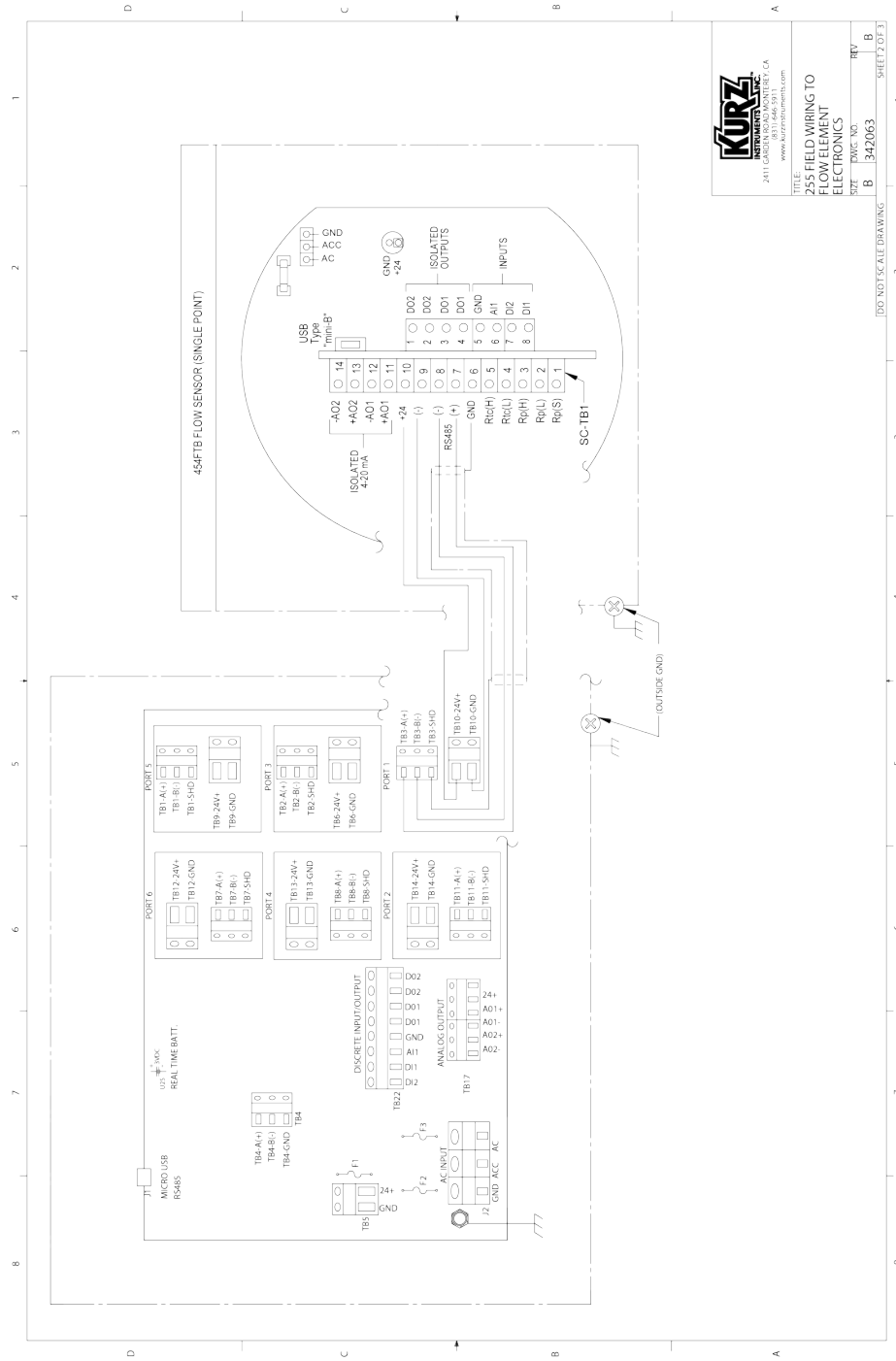
Series 255 Field Wiring Diagram (4 of 4)



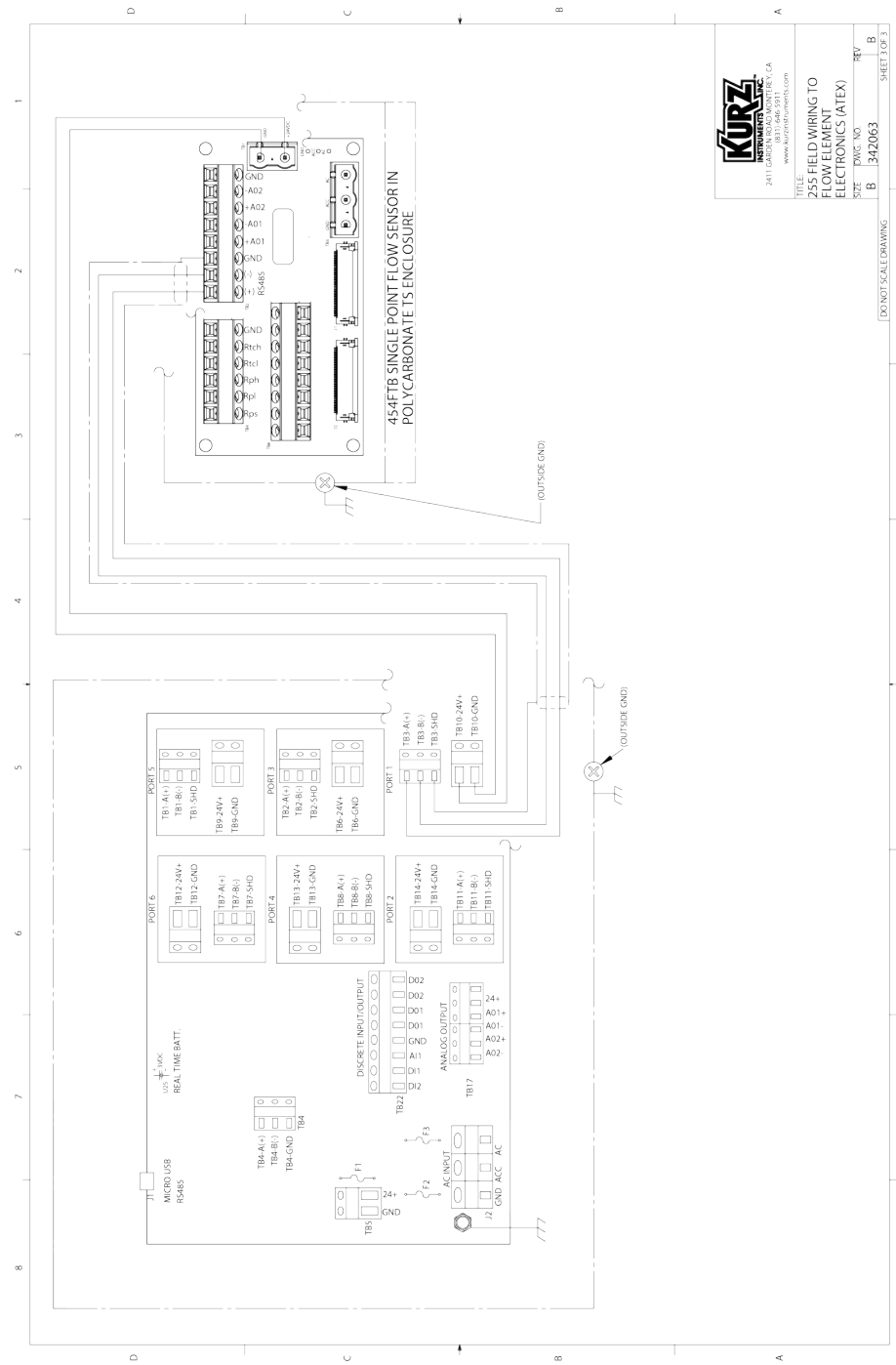
Series 255 Field Wiring to Flow Element (1 of 3)



Series 255 Field Wiring to Flow Element (2 of 3)



Series 255 Field Wiring to Flow Element (3 of 3)



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