MultiLoad II & RCU II
Explosion Proof Lite (EXL)
Installation Guide

(Part # 6070)

MAY 2019

TOPTECH SYSTEMS

MultiLoad II & RCU II – Explosion Proof Lite (EXL) Installation Guide

1124 Florida Central Parkway

Longwood, FL 32750

USA

Phone +1 (407).332.1774

Copyright Notice

Disclaimer

Toptech Systems assumes no responsibility for damages resulting from installation or use of its products. Toptech Systems will not be liable for any claims of damage, lost data, or lost time as a result of using its products.

EU Declaration of Conformity

The signatory, representing the manufacturer, declares that the products listed below are in conformity with the essential requirements of the following EC Directive(s) when installed in accordance with the product installation instructions:

2014/32/EU	The Measuring Instruments Directive (and its amending directives)
2014/30/EU	The Electromagnetic Compatibility Directive (and its amending directives)
2014/34/EU	The Potentially Explosive Atmospheres Directive (and its amending directives)
Product:	Operator Interface/Process Control Equipment intended for use in potentially explosive atmospheres
Model name/number:	MultiLoad II EXL (MID, YES), RCU II EXL (MID, NO)
Protective Systems:	Flameproof 'd', Intrinsic Safety 'ib'
Notified Body(ies)	Det Norske Veritas Certification AS, Number 0575 Veritasveien 1 1322 Høvik, Norway
	NMi Certin B.V., Number 0122 Hugo de Grootplein 1 3314 EG Dordrecht The Netherlands

Conformity has been demonstrated with reference to the following documentation:
EC type-examination certificate : Presafe 17 ATEX 9557X
IECEx CoC : IECEx PRE 17.0013X
EC type-examination certificate : TC7311

Compliance with the Essential Health and Safety Requirements has been assessed by reference to the following standards:

WELMEC guide 8.8	General and Administrative Aspects of the Voluntary System of Modular Evaluation of Measuring instruments under MID
OIML R117-1:2007(E)	Dynamic measuring systems for liquids other than water
EN 61000-6-4: 2007	Generic emissions for industrial operating environments
EN 61000-6-2: 2005	Generic immunity for industrial operating environments
EN 60079-0: 2012	Electrical apparatus for explosive gas atmospheres—General requirements
EN 60079-1: 2014	Electrical apparatus for explosive gas atmospheres— Flameproof enclosures 'd'
EN 60079-11: 2012	Electrical apparatus for potentially explosive atmospheres—Intrinsic safety 'i'

Year of CE Marking: 2007

Name: William J. Porthouse **Position:** Director of Engineering & Production **Date:** 14-May-2019

Name Plate

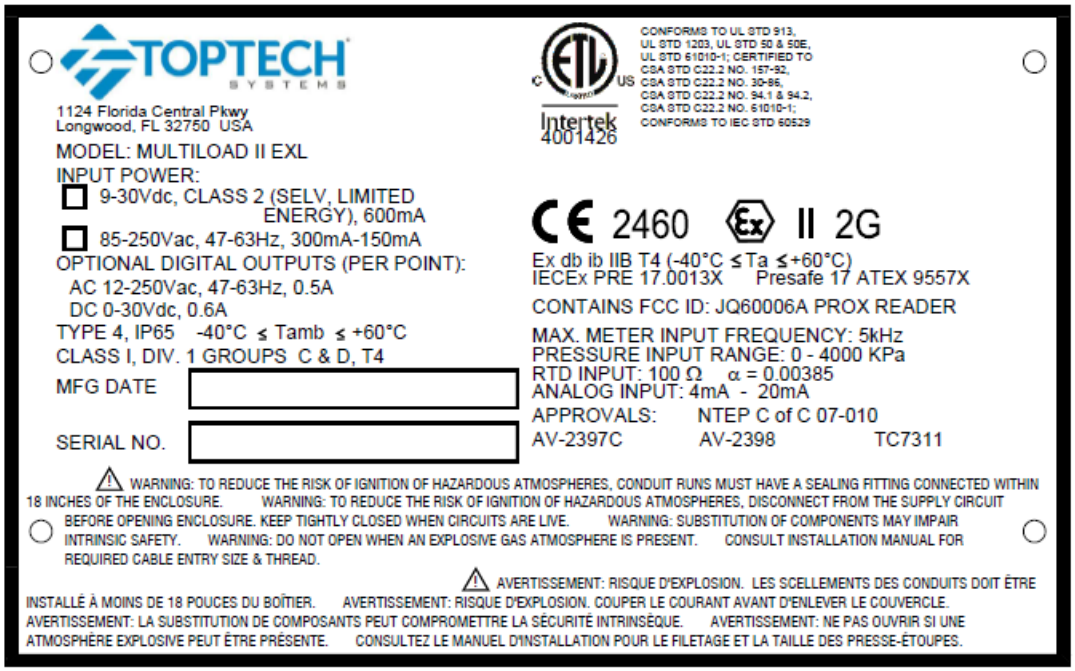


Table of Contents

Table of Figures

Overview

This document is designed to guide individuals installing MultiLoad II/ RCU II EXL equipment, engineering firms developing site electrical drawings, and users troubleshooting system operations such as managers, system administrators, technicians, and meter proving personnel.

The following table provides an informative summary of the material available in this guide:

Chapter	Topics Covered
1. General Information and Warnings	This chapter reviews safety and compliance information, as well as instructions for receiving and returning products.
2.Operating Conditions & Components	This chapter covers product outline and dimensions, as well as operating characteristics of the unit.
3.Installing the MultiLoad II/RCUII – EXL	This chapter covers installation considerations and instructions for the the Explosion Proof Lite (EXL) Model.
4.Data Communication Interface	This chapter reviews hardware connections and communication processes.
5.Connecting Field Devices to the Internal I/O Board	This chapter covers the available I/O points per board, the terminal arrangements per board, and then describes in detail how to connect different field devices to the internal I/O Board.
6. Configurations	This chapter describes how to navigate the system, select field values, perform data entry, and toggle options on and off.
7. Service and Repair	This chapter describes how to service and repair the MultiLoad/ RCUII EXL subassemblies and parts.
8. Hardware Revision History & Compatibility	This chapter provides changes, modifications, and updates to the hardware.
9. Revision History	This chapter provides further hardware revisions as well as revisions made to this document.

The following keys allow the user to locate information needed in this guide:

ICON KEY	
	Important information to enhance understanding and make better use of the product.
	Indicates potential damage to hardware or loss of data.
	Potential for property damage or that personal injury may occur. Pay close attention and follow instructions when this symbol is displayed.

Typographical Conventions:

Boldface: Indicates what is pressed on the keypad. Example: Key in **00000.**

Italics: Emphasizes a key product or industry term.
Example: the display features a pick-list style of item selection.

This guide covers RCU/MultiLoad EXL installation information only. For information about base MultiLoad firmware, please consult the MultiLoad II User Guide. For information about wiring other models, please consult the respective installation guides. For information about the MultiLoad register interface and Modbus communication, please reference the MultiLoad II Communication Guide. Updated versions of all manuals, including this one, are available on our website at http://www.toptech.com.

Chapter 1

Chapter 1 General Information & Warnings

1.1 Receiving and/or Returning Equipment

At receipt, the MultiLoad II/ RCU II should be immediately inspected after opening the packaging case. If any damage is visible, notify the carrier at once to establish liability.

Contact Toptech's Return Materials Department to initiate timely repair or replacement of the unit.

A Return Materials Authorization (RMA) will be for the purpose of returning the product or parts requiring repair. Do not return any material to Toptech without an RMA.

Contact Information for Americas:

Return Materials Department
Toptech Systems, Inc.
1124 Florida Central Pkwy
Longwood, FL 32750 USA
+1 (407) 332-1774

Contact Information for EMEA and Asia:

Return Materials Department
Toptech System NVs
Nieuwe weg 1- haven 1053
2070 Zwijndrecht, BELGIUM
+32 (0)3 250 60 60

1.2 Safety Warnings

NORTH AMERICAN INSTALLATIONS:

- This equipment is suitable for use in Class I, Division 1, Groups C and D locations, OR non-hazardous locations.
- **WARNING: TO REDUCE THE RISK OF IGNITION OF HAZARDOUS ATMOSPHERES, conduit runs must have a sealing fitting connected within 18 inches of the enclosure.**
- **WARNING: TO REDUCE THE RISK OF IGNITION OF HAZARDOUS ATMOSPHERES, disconnect from the supply circuit before opening enclosure. Keep tightly closed when circuits are live.**
- **WARNING: Substitution of components may impair intrinsic safety.**
- **WARNING: Do not open when an explosive gas atmosphere is present.**
- **WARNING: All unused conduit entries must be sealed with a conduit plug which satisfies the flameproof "d" method of protection.**
- **CAUTION: Battery may explode if mistreated. DO NOT RECHARGE, DISASSEMBLE, OR DISPOSE OF IN FIRE.**
- **CAUTION: Field wiring must have a temperature rating of +75 °C or greater.**
- **Consult installation manual for required cable entry size and thread.**
- A battery is soldered to the processor board for retention of data, time, and date. This battery should last more than ten years. Please return the board to Toptech Systems for battery replacement. This battery must be replaced with Matsushita Electric, model BR2477A only. Use of another battery may present a risk of fire or explosion.
- The installation of this product must be in conformity with NFPA 70 (US National Electric Code) or CSA C22.1 (Canadian Electrical Code) as appropriate.

INSTALLATIONS NORD-AMÉRICAINES (FRANÇAIS)

- Cet équipement est compatible pour une installation en Classe I, Division 1, Groupes C & D ou les emplacements non dangereux.
- **AVERTISSEMENT: RISQUE D'EXPLOSION Les scellements des conduits doit être installé à moins de 18 pouces du boîtier.**
- **AVERTISSEMENT: RISQUE D'EXPLOSION Couper le courant avant d'enlever le couvercle. Garder le couvercle bien fermé tant que les circuits sont sous tension.**
- **AVERTISSEMENT: La substitution de composants peut compromettre la sécurité intrinsèque.**
- **AVERTISSEMENT: Ne pas ouvrir si une atmosphère explosive peut être présente.**
- **AVERTISSEMENT: Toutes les entrées du boîtier inutilisées doivent être scellées avec un bouchon de conduit.**
- **PRUDENCE: La pile peut exploser si elle est maltraitée. NE PAS RECHARGER, NE PAS DÉMONTER, ET NE PAS JETER DANS LE FEU.**
- **PRUDENCE: Câblage de terrain doit avoir un classement de température de +75 °C ou plus.**
- **Consultez le manuel d'installation pour le filetage de forme et la taille du presse-étoupe.**

Suite à la page suivante

INSTALLATIONS NORD-AMÉRICAINES (FRANÇAIS, *suite de la page précédente***)**

- Une pile est soudée à la carte processeur pour la conservation des données, de l'heure, et de la date. Cette pile devrait durer pendant plus que dix ans. Veuillez retourner la carte processeur à Toptech Systems pour le remplacement de la pile. R**emplacez la pile avec Matsushita Electric, modèle BR2477A seulement. Utiliser une autre pile peut présenter un risque d'incendie ou d'explosion.**
- L'installation de ce produit doit se conformer avec NFPA 70 ou CSA C22.1 comme appropriée.

ATEX AND IECEX INSTALLATIONS:

- This equipment is suitable for use in Ex Zone I Group IIB locations or non-hazardous locations.

  THE LETTER "X" TO THE RIGHT OF THE CERTIFICATE NUMBER INDICATES THE FOLLOWING SPECIAL CONDITIONS FOR SAFE USE:

  - **CERTAIN FLAMEPROOF JOINTS ARE OTHER THAN THE MINIMUM OR MAXIMUM DIMENSIONS GIVEN IN IEC/EN/BR 60079-1, CLAUSE 5. PLEASE CONSULT TOPTECH SYSTEMS IF DIMENSIONAL INFORMATION IS REQUIRED.**
  - **MAXIMUM SPECIFIED GAP OF FLANGE JOINT IS 0.08mm.**
  - **AMBIENT TEMPERATURE RANGE IS BETWEEN -40°C AND +60°C.**
  - **CAUTION: COVER BOLTS MUST HAVE A YIELD STRESS OF AT LEAST 700 N/mm².**
- **WARNING: TO REDUCE THE RISK OF IGNITION OF HAZARDOUS ATMOSPHERES, disconnect from the supply circuit before opening enclosure. Keep tightly closed when circuits are live.**
- **WARNING: Substitution of components may impair intrinsic safety.**
- **WARNING: Do not open when an explosive gas atmosphere is present.**
- **WARNING: All unused conduit entries must be sealed with a conduit plug which satisfies the flameproof "d" method of protection. Blanking elements must be removable with the aid of a tool, ATEX certified, suitable for Gas Group IIB and suitable for an ambient temperature range of -40 C to +60 C.**
- **CAUTION: Battery may explode if mistreated. DO NOT RECHARGE, DISASSEMBLE, OR DISPOSE OF IN FIRE.**
- **CAUTION: Field wiring must have a temperature rating of +75 °C or greater. It must also have a temperature rating for the lowest expected minimum ambient temperature.**
- **Consult installation manual for required cable entry size and thread.**
- A battery is soldered to the processor board for retention of data, time, and date. This battery should last more than ten years. Please return the board to Toptech Systems for battery replacement. This battery must be replaced with Matsushita Electric, model BR2477A only. Use of another battery may present a risk of fire or explosion.
- The installation of this product must be in conformity with IEC/EN/BR 60079-14

1.3 Electrostatic Discharge (ESD) Protection

The MultiLoad II/ RCU II contains electronic components and assemblies subject to damage by ESD. The MultiLoad II/ RCU II was designed to protect against ESD while the unit is closed and in normal operation. Proper handling procedures must be observed during the removal, installation, repair and other handling of printed circuit board assemblies, electronic devices and components. This includes:

1) Service to be performed by authorized personnel only.
2) The person performing the service must be grounded by an ESD grounding strap and connected to ground.
3) While performing maintenance or repair, touch an unpainted metal of the MultiLoad II/ RCU II surface prior to touching or handling any printed circuit boards or electronic components.
4) Printed circuit board assemblies must be placed in and transported in conductive bags or other conductive containers.
5) Printed circuit boards must not be removed from the conductive container until time of use.
6) All other “best” practices for protecting devices from ESD must be observed.

1.4 FCC Note

This equipment complies with the limits for a Class A Digital Device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at their expense.

Modifications not approved by the manufacturer could void the user's authority to operate the equipment under FCC rules.

Chapter 2

Chapter 2 Operating Conditions and Components

2.1 Product Outline and Dimensions

2.1.1 MultiLoad II/ RCU II – EXL Model - Picture

Figure 2.1 MultiLoad II (ML II) / Remote Control Unit II (RCU II) Explosion Proof Lite (EXL)

2.1.2 MultiLoad II/ RCU II – EXL Model – Dimensions

The dimensions in this section are indicated in inches and millimeters (in parenthesis).

2.1.2.1 Front View

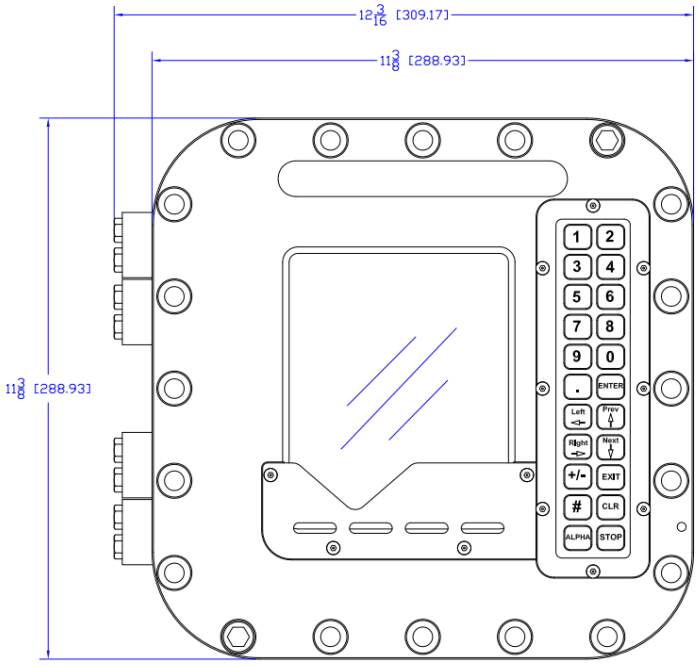


Figure 2.2 Unit Outline Drawing – Front View

2.1.2.2 Back View

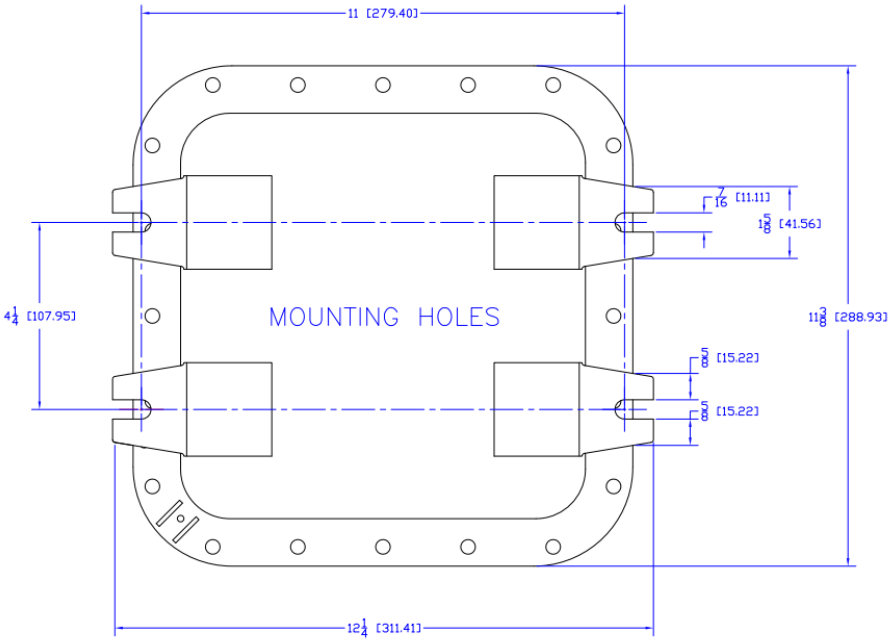


Figure 2.3 Unit Outline Drawing – Back View

2.1.2.3 Bottom View

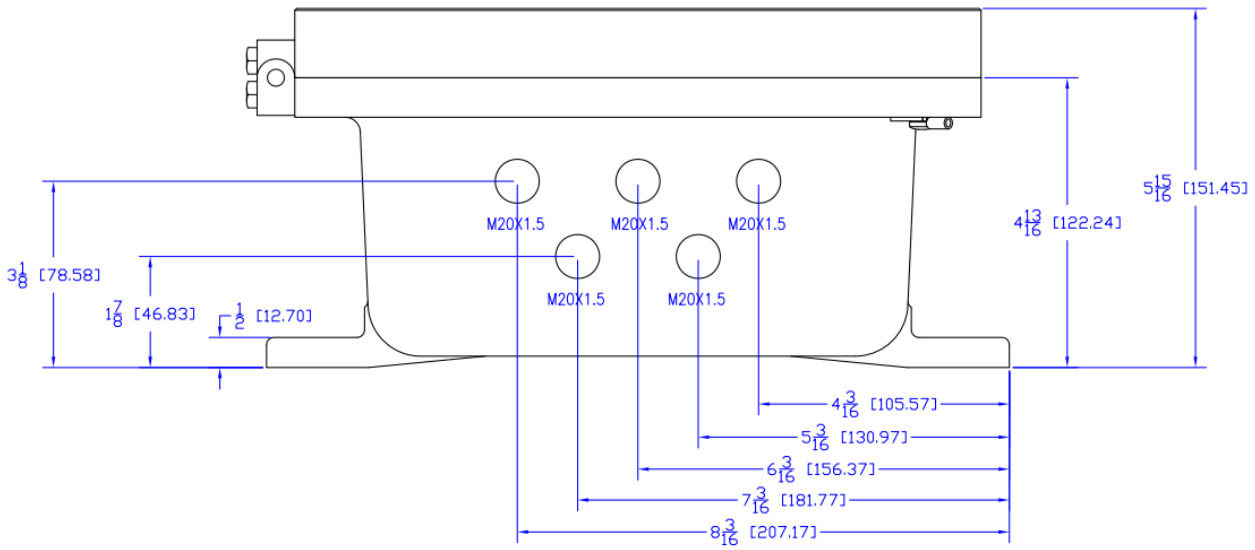


Figure 2.4 Unit Outline Drawing – Bottom View

2.1.2.4 Side View

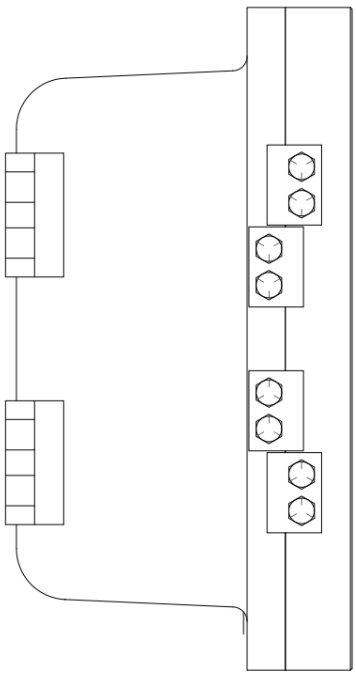


Figure 2.5 Unit Outline Drawing – Side View

2.2 Operating Characteristics

The **MultiLoad II/ RCU II – Explosion Proof Lite (EXL) Model** has the following characteristics:

Characteristics	Description
Operating Voltage ***Voltage Option***	85 - 250 Vac, 47-63 Hz, 300 – 150 mA ***9 - 30 Vdc, 600mA***
Operating Temperature	40°F to 140°F, -40°C to 60°C
Enclosure	Type 4, IP65 ETL Listed (US, Canada) Class I, Division 1, Groups C & D, T4
Weight	24 lbs : 11 kg
Display	Color 8.4" Diagonal VGA
Prox Card Reader	Captive or Non-captive: supports TWIC
Lockable External W&M Bolts	Program Access, Weights & Measures Parameter Access (on MultiLoad only)
Keypad	47 Key Alpha/ Numeric Membrane Switch Keypad
Communications	3 serial ports (1 RS-485, 2 User Selectable RS-232 or RS-485) 1 Ethernet port 10/100 Mbps

Internal I/O Options: Two versions of an optional internal I/O board are available:

- the Digital/ Analog I/O Board
- the 2 Meter I/O Board

The quantity and electrical ratings of each I/O are described in the table below:

Type I/O	Digital/ Analog I/O Quantity, Location	2 Meter I/O Quantity, Location	Electrical Rating
AC Outputs:	5 (TB1)	8 (TB2, TB3)	12 - 250 Vac rms, 500 mA (per point), TB1
AC Inputs	0	2 (TB1)	90 - 250Vac
DC Outputs:	3 (TB3)	2 (TB9)	0 - 30 Vdc, 600 mA (per point), TB3
DC Inputs:	5 (TB2-Right) (2 High Speed)	6 (TB7, TB8) (4 High Speed)	5 - 30Vdc, TB2B Dual Channel flow meter inputs (1-5000Hz) Miscellaneous signal inputs
12Vdc Source:	167mA Max Load (TB2-Left)	250mA Max Load (TB6)	Isolated Power Supply Power for flow meter pulsers or preamps
RTD Input:	1 (TB4)	2 (TB4, TB5)	100-ohm platinum, four wire Coefficient 0.00385 Ohm/Ohm/°C
Analog Input	1 (TB5)	0	4 - 20mA, 1.5V maximum burden
Analog Output	1 (TB6)	0	4 - 20mA, Requires 12Vdc – 30Vdc Supply

Internal I/O Heat Dissipation:

I/O TYPE	Voltage [V]	Freq [Hz]	Dissipation per Point [W]	Digital/ Analog I/O		2 Meter I/O	
				# I/O	TOTAL Dissipation [W]	# I/O	TOTAL Dissipation [W]
ACOUT	230	50	0.36	5	1.78	8	2.85
	120	60	0.32	5	1.62	8	2.60
ACIN	230	50	0.73	0		2	1.46
	120	60	0.44	0		2	0.89
DCOUT	5	--	0.02	3	0.07	2	0.05
	12	--	0.02	3	0.07	2	0.05
	24	--	0.02	3	0.07	2	0.05
	30	--	0.02	3	0.07	2	0.05
DCIN	5	--	0.00	6	0.03	6	0.03
	15	--	0.06	6	0.33	6	0.33
	24	--	0.16	6	0.97	6	0.97
	30	--	0.23	6	1.41	6	1.41
4-20 mA Input	--	--	0.03	1	0.03	0	--

*I/O points dissipating 1 mW or less are not reported.

Chapter 3

Chapter 3 Installing the MultiLoad II/RCUII EXL

3.1 Tools Required

3.1.1 Installation

- -8 mm hex wrench required for tightening cover bolts.

3.1.2 Servicing and Repair

- #2 Philips screwdriver for circuit board removal.
- ¼" socket wrench for CPU circuit board removal and a 5/16" socket wrench for display board removal.
- - Torx T10 for removal of keypad bezel security screws.

3.2 Cover Closure and Bolt Replacement

The enclosure cover is secured to the housing by twenty 10mm hex cap screws. An 8mm Allen head wrench is required to remove the screws. After the bolts are removed, the front cover will swing left and hang from its hinges. To close the cover, gently lift on the bottom right corner when in position and start one or two of the lower right corner bolts. This is done to assist in alignment of the cover and base holes for starting the bolts. Dry stainless steel fasteners can gall or seize in aluminum, so please be sure to use a petrolatum or a similar lubricant.

Be sure to keep the flanges clean and free of scratches so as not to compromise the quenching ability of the flame path.

All cover bolts must be tightened to maintain the explosion proof capability of the enclosure.

3.3 Cable Entries

Five M20 x 1.5 mm apertures in the enclosure bottom are provided for the installation of cable glands. A gland with the correct corresponding thread must be installed in the opening.

WARNING: If there are unused holes, blanking elements satisfying the flameproof "d" method of protection must be used. Blanking elements must be removable with the aid of a tool, ATEX certified, suitable for Gas Group IIB and suitable for an ambient temperature range of -40 C to +60 C.

3.4 Mounting the MultiLoad II/ RCU II DIV-2 Enclosure

The EXL enclosure should be located in a shaded area. Direct sunlight can increase internal temperature to greater than 140°F or 60°C.

Exterior dimensions of the standard MultiLoad II/ RCU II Explosion Proof Lite (EXL) enclosure are shown in Figures 2.2 – 2.5. There is only one mounting orientation possible as shown in Figure 2.2. Five M20x 1.5 mm cable entries are located at the bottom of the unit.

Appropriate fasteners must be selected to support the minimum weight of 33 lbs. (15 kg). Toptech offers the following mounting suggestions for three typical surfaces: metal, wood, or concrete/solid block.

3.4.1 Metal Plate or Rail

Use four hex head 3/8" OD (M10) bolts with a 3/8" flat washer, 3/4" OD (M10, 20mm OD) under the head of the bolt. Tighten with four 3/8" (M10) hex nuts.

3.4.2 Wood

Use four hex head 2" x 3/8" OD (M10 x 50 mm) lag bolts with a 3/8" flat washer, 3/4" OD (M10, 20 mm OD) under the head of the bolt. Or, you may drill through holes in the wood and assemble as with the metal plate using four hex head 3/8" OD (M10) bolts with a 3/8" flat washer, 3/4" OD (M10, 20 mm OD) under the head of the bolt. Tighten with four 3/8" (M10) hex nuts.

3.4.3 Concrete or Cinder Block Walls

Use four Sleeve, Bolt and Stud Anchors, Hex Nut 3/8"OD, 2 1/4"long or a metric equivalent.

3.4.4 Mounting Height Considerations

When mounting the enclosure, be aware of the limitations that the cover places on screen visibility. Because the display is inset about an inch [25mm] from the surface of EXL and SMP units and the screen is inset an inch-and-one-half [39mm] in the EXL unit, the enclosure should be mounted so that top of the screen's visible area is at eye level of the tallest operator. Figure 3.1 shows the visible area at arm's length and the distance from the ground to the top mounting hole location for a six foot [1.8m] tall user. Figure 3.2 shows the offset of the top of the screen's visible area from the top mounting bolt and the depth of the screen within the unit.

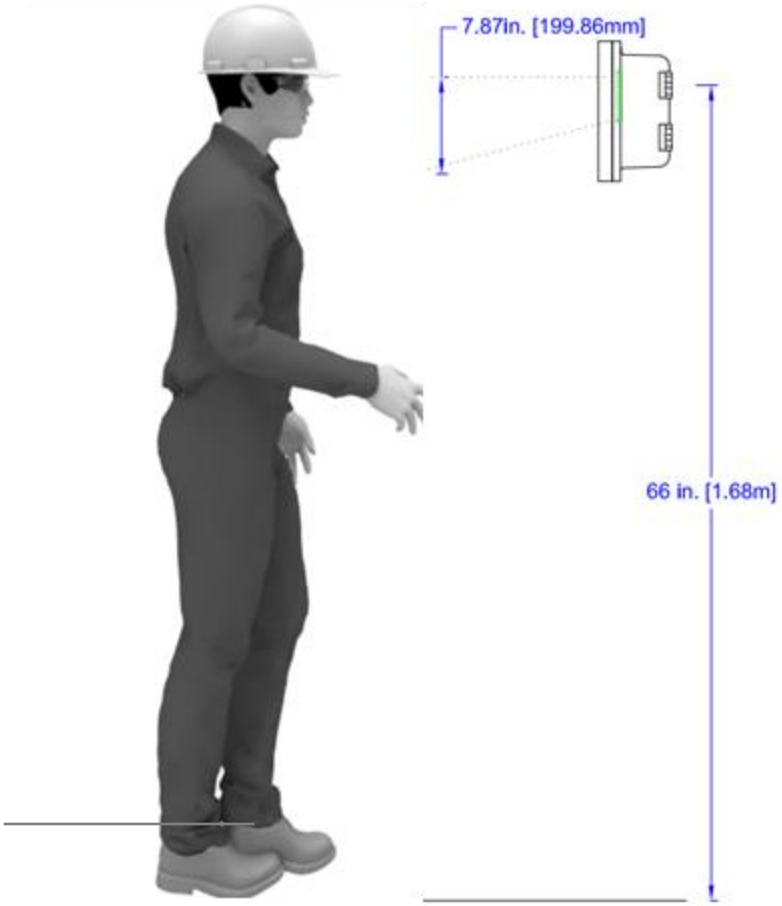


Figure 3.1 Suggested Mounting Position

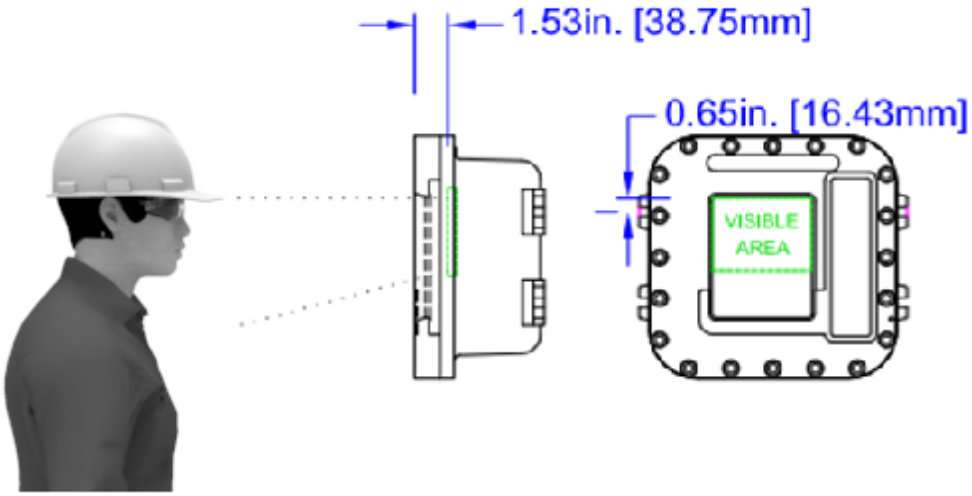


Figure 3.2 Screen Visible Area

3.5 Recommended Wire Sizes and Torque for All Terminal Blocks

Three sizes of terminal blocks are used in the MultiLoad II/ RCU II products: 7.62 mm pitch (supply power), 5.08 mm pitch (line voltage switching), and 3.81 mm pitch (serial communication, analog or dc voltages). The 7.62 and 5.08 mm terminal blocks have an allowable wire size of 24 AWG – 12 AWG and should be tightened to 0.55 Nm +/-0.05 Nm (5 lb in +/- 0.4 lb in).

The 3.81 mm terminal blocks have an allowable wire size of 28 AWG – 16 AWG and should be tightened to 0.23 Nm +/-0.02 Nm (2 lb in +/- 0.2 lb in).

3.6 Electrical Supply Connections

The MultiLoad II/ RCU II may be equipped for either 85 -250Vac or 24Vdc operation. Verify the power type before making any connections.

To reduce the risk of ignition in hazardous atmospheres, conduit runs must have seals Installed within 18 inches (45 cm) of the enclosure.

Field wiring must have a temperature rating of 75°C or greater.

3.6.1 Cable Gland Entries

Five M20 x 1.5 mm apertures in the enclosure bottom are provided for the installation of cable glands. A gland with the correct corresponding thread must be installed in the opening.

WARNING: If there are unused holes, blanking elements satisfying the flameproof “d” method of protection must be used. Blanking elements must be removable with the aid of a tool, ATEX certified, suitable for Gas Group IIB and suitable for an ambient temperature range of -40 C to +60 C.

Do not route AC and DC wiring in the same conduit.

All wiring must enter the MultiLoad II/ RCU II enclosure through conduit fittings or cable glands in the bottom of the enclosure. All conduit fittings or cable glands used must be appropriately-rated.

Wires must be stripped ¼” and fully inserted into terminal block with no bare conductor exposed. Review section 3.5 for recommended wire size and torque values.

Both ac and dc input models require a safety ground connection as described in section 3.6.4 below.

A service loop is recommended for all wires and cables entering the enclosure.

Do not allow service loop cables to overlap the circuit boards. Coil any cable length in the bottom of the enclosure. Keep AC wiring separated from all other wiring in the enclosure.

Wiring must comply with all local electrical codes.

3.6.2 AC Powered Models

Provide over current protection using a 15 Amp circuit breaker or equivalent. The breaker also serves as a means of disconnection from the operating supply as required by UL/ISA/IEC 61010-1 and CAN/CSA-C22.2 NO. 61010-1. The disconnected device may not be blocked or be made difficult to operate by the MultiLoad II/ RCU II or any other device. Note that installation of disconnects are typically prohibited in Class I, Division 1 or Division 2 locations.

Power required: 85 – 250 Vac, 47 – 63 Hz, 300 mA @ 85Vac/ 150 mA @250Vac. The power connector is located in the right hand, bottom corner of the Power Supply/Communication board as shown in figure 3.3. Select supply wire rated 300V or better with a flammability rating of at least VW-1.

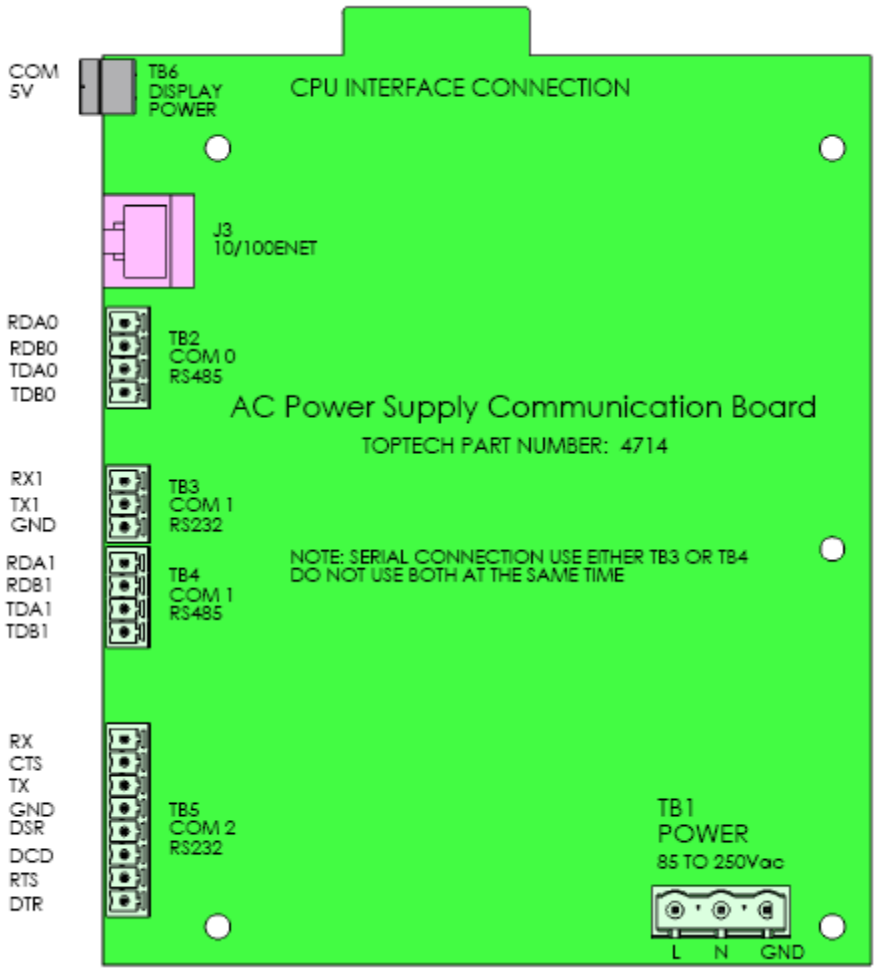


Figure 3.3 MultiLoad II/ RCU II AC Power Supply/Comm Board

3.6.3 DC Powered Models

The MultiLoad II/ and RCU II is optionally available with a 24 Vdc power supply. The power source used to supply the MutliLoad II/RCUII must be rated 9 – 30 Vdc SELV, Limited Energy (Class 2). The rated supply input current is 600mA. The supply should be protected by a 1.5 Amp fuse.

The 4-position terminal block is located in the right-hand corner of the power supply/communication board. The left-most terminal position is a spare and will not be used.

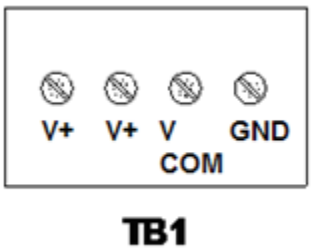


Figure 3.4 DC Power Connections

Wiring guidelines for using 24 Vdc power supply:

Wire gauge (AWG)	Distance (feet)
24	50
22	100
20	150
18	250
16	400

3.6.4 Equipment Grounding

A safety ground should be attached to terminal block TB1 (on both ac and dc input power models) to maintain electrical safety in the event of a fault condition. Follow the terminal block wiring instructions in section 3.6. Keep the required tightening torque in mind (section 3.5).

The external ground connection is not provided for the attachment of the protective conductor (the safety ground). Rather, it is provided only as a supplemental bonding connection where local authorities permit or require such a connection: for example, as a means of equipotentiality. The wire connection is on the bottom right exterior surface. The following wire sizes may be used: 10 AWG (5.26 mm^2) or 11 AWG (4.17 mm^2).

Do not connect the power supply dc common to earth ground.

Chapter 4

Chapter 4 Data Communications Interface

The MultiLoad II/ RCU II has four (4) communications ports (see Figure3.3), each with a specific purpose. The following section provides the information required to select and make the wiring connections to the ports:

Communication Port	Interface Type	Typical Function	Terminal (Figure 3.3)
Comm. Port 0	RS-485	Internal I/O board / FCM I / FCM II / PCM Communication	TB2
Comm. Port 1	RS-232 or RS-485	Host Communication (TMS) / Printer	TB3 RS-232 TB4 RS-485
Comm. Port 2	RS-232 or RS-485 (2 wire)	Ticket Printer/Data Logger	TB5
Ethernet	10/100Mbps	Host Communication (TMS)	J3 Cat 5 (or higher) cable

If a service loop is used, the maximum wire length in the service loop should not exceed 3 inches [75mm].

Separate AC and DC wiring by at least 3 inches [75mm]. Do not allow excess wire in the service loop to overhang printed circuit board.

Default settings in MultiLoad are: COM O – FCM ; COM 1- HOST , and COM2 – NA.See the user guide for more details.

Only one port may be defined as an FCM, Print or Alibi Log, otherwise, a ‘Port Usage Conflict(s)’ message will display upon re-boot. See the user guide for more details.

4.1 Available Communications Protocol Selection and Wire Spec

This section describes the available communication protocols for MultiLoadII/RCU II.

4.1.1 RS-422/485

The RS-422/485 communications protocol is designed for multi-point (i.e. computer to multiple devices, also called multi-dropped) communications up to 4,000 feet (1,220 Meters).

RS-422 requires 4-wires (2 twisted pair) for full duplex communications and utilizes a transmit pair of wires (TDA & TDB) and a receival pair of wires (RDA & RDB).

RS-485 requires 2-wires (1 twisted pair) for half duplex communications and utilizes a single pair of wires (TDA/RDA & TDB/RDB) for transmittal and receival

This manual will typically refer to both RS-422 and RS-485 as simply RS485 2 Wire or RS485 4 Wire.

Although a ground wire is not required, the common mode voltage between the MultiLoad II/ RCU II and the field device must be within -7Vdc to 12Vdc. To correct situations where this is not the case, the DC common is available on COM 0 and COM 1 by using TB2, pin five (revision 1.1 Power Supply/Comm boards only) and TB 3, pin three. Connect the MultiLoad II/ RCU II DC common to the signal ground of the field device

Wire used must meet the following characteristics:

- 24 AWG stranded.
- 4-wire, two twisted pair with overall shield.
- 2-wire, one twisted pair with overall shield.
- 30 pF maximum between conductors.
- 1,000 ohm impedance.
- Maximum length: 4,000 feet (1,220 Meters).
- Maximum stub length: 15 feet.

All exposed shields must be properly insulated to prevent short circuits.

All shields must be continuous, soldered, and properly insulated.

4.1.2 RS-232

The RS-232 protocol is designed for point-to-point (i.e., computer to a single device) communications limited to 50 feet requiring a minimum of 3 wires: transmit, receive and ground. Additional wires are required for hardware handshaking when using printers and data loggers.

Wire used must meet the following characteristics:

- 24 AWG.
- 3 conductor with overall shield (data only) or 8 conductor with overall shield (full handshaking).
- 30 pF maximum between conductors.

4.1.3 Ethernet

The Ethernet controller on revision 2.0 CPU boards uses HP Auto-MDIX technology. By automatically detecting the signaling on the connected device, the transceiver will configure the port settings automatically. Thus, the choice of a straight through or cross over cable no longer has to be made—either will work.

Ethernet is available on MultiLoad II/RCUII with revision 2.0 or higher CPU boards.

Wire used must meet the following characteristics:

- Ethernet wiring standard T568B - Cat5 cable (or greater).

4.2 Communication Connection Wiring

This section describes the wiring connections for each of the communication ports in order to function for a specifc communication protocol.

4.2.1 FCM I/ FCM II Communications (MultiLoad II Only) - COM 0 –Port – RS485

FCM I, FCM II and PCM modules communicate with the MultiLoad II using the COM0. This is a dedicated communication line.

The FCMII modules linked to a specific MultiLoad II are all on a RS-485 bus connected this COM 0 port.

The TD and RD pairs are swapped at the MultiLoad II.

If an internal I/O board is installed, this board is already connected to COM 0 and is addressed as FCM #0.

All FCMs must be uniquely addressed.

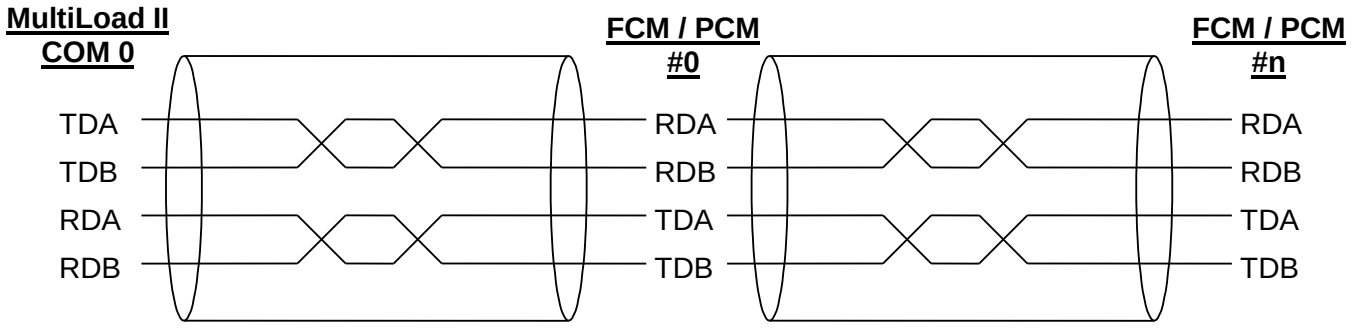


Figure 4.1 FCM / PCM Connections

4.2.2 Host/TMS Communications

A host/ TMS computer system can be connected to the MultiLoad II/ RCU II in various ways :

- RS485 4-wire on COM 1
- RS485 2-wire on COM1
- RS232 on COM1
- Ethernet on the ethernet port

4.2.2.1 COM 1 - RS-485 4-wire - Host/TMS Communications

A host/ TMS computer system can be connected to the MultiLoad II/ RCU II via RS485 4-wire on COM 1.

The TD and RD pairs are swapped at the Host/TMS.

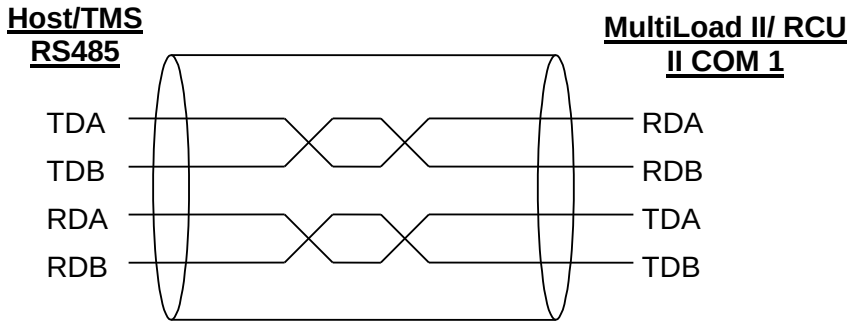


Figure 4.2 RS485 4-Wire, Host to a Single MultiLoad II/ RCU II (recommended)

MultiLoad II/RCUII can be multridropped on the same communication line using a RS485 – 4 Wire on COM 1 to communicate to a host system.

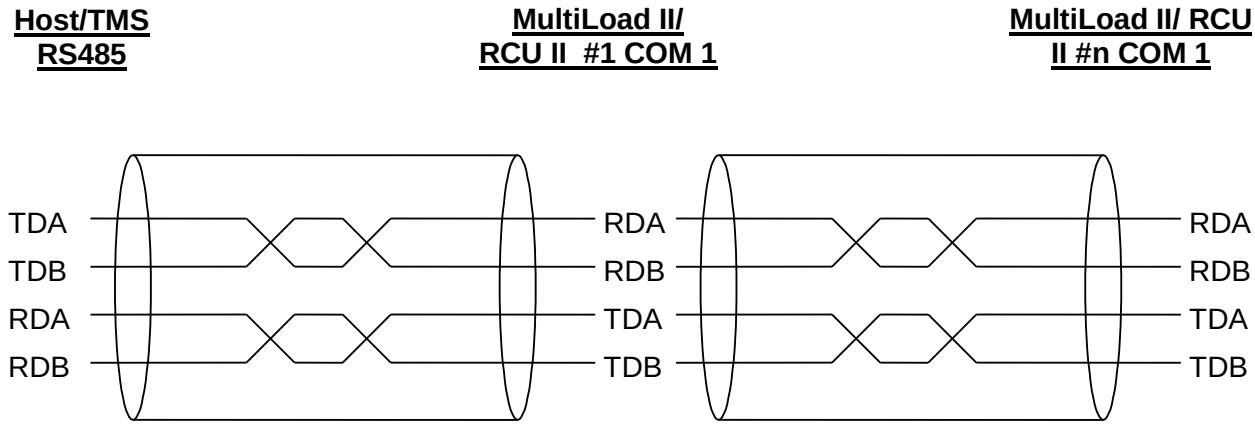


Figure 4.3 RS485 4-Wire, Host to Multiple MultiLoad II/ RCU IIs

4.2.2.2 COM 1 - RS-485 2-Wire: Host/TMS Communications

The Host/TMS Computer System can be connected to the MultiLoad II/ RCU II via RS485 2-Wire on COM 1.

The TD and RD pairs tied together at the Host/TMS and all MultiLoad II/ RCU IIs.

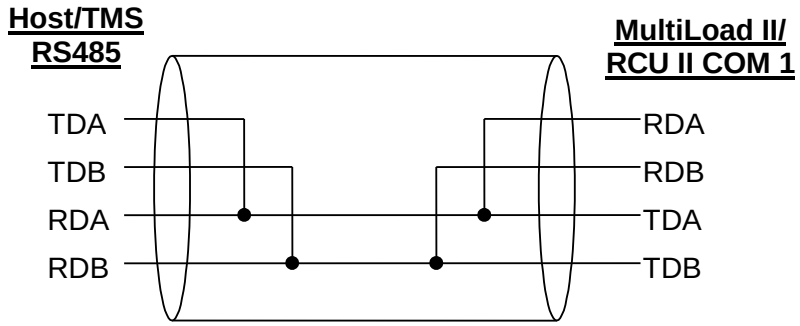


Figure 4.4 RS485 2-Wire, Host to a Single MultiLoad II/ RCU II

MultILoad II / RCU II can be multidropped on the same communication line using RS485 – 2 Wire on COM 1:

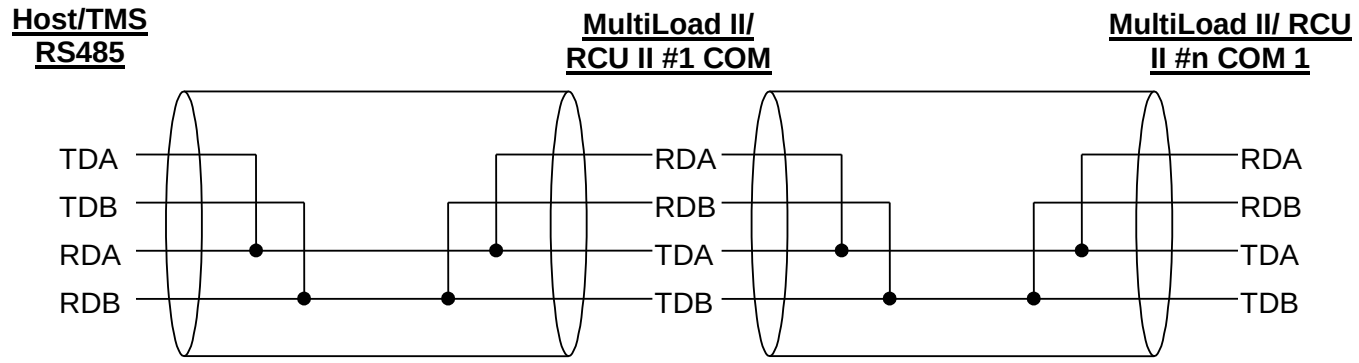


Figure 4.5 RS485 4-Wire, Host to Multiple MultiLoad II/ RCU IIs

4.2.2.3 COM 1 - RS-232 - Host/TMS Communications

The Host/TMS Computer System can be connected to the MultiLoad II/ RCU II via RS232 on COM 1.

The TX and RX are swapped at the Host/TMS.

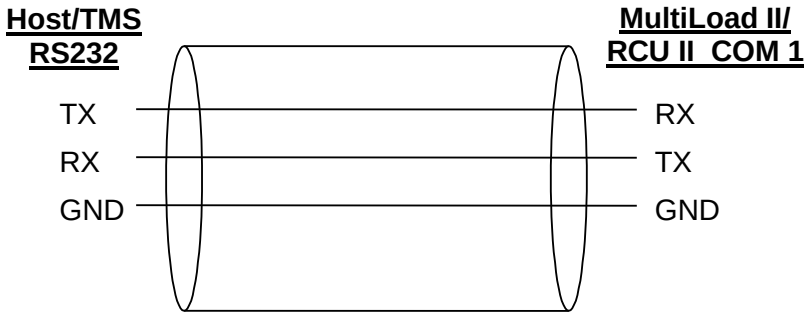


Figure 4.6 RS232, Host to a Single MultiLoad II/ RCU II

MultiLoad II/RCUII has the ability to multi-drop onto a RS232 line on COM 1:

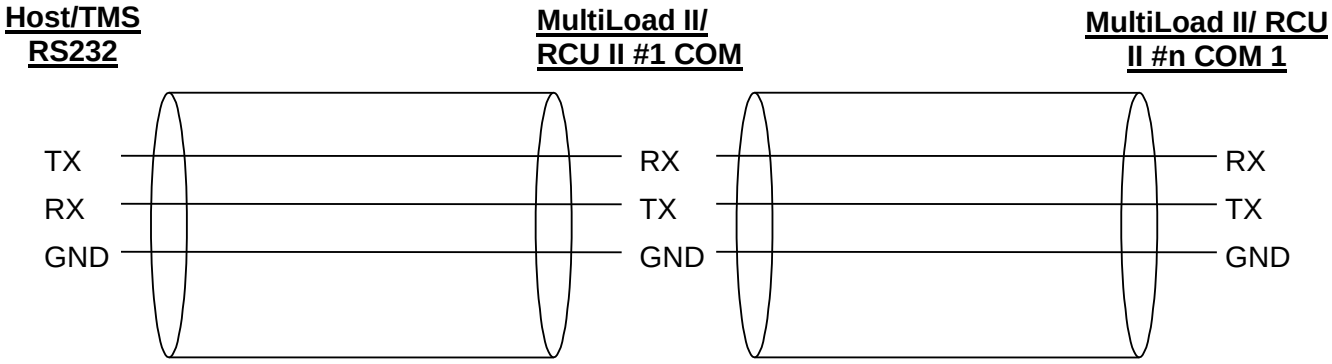


Figure 4.7 RS232, Host to Multiple MultiLoad II/ RCU IIs

4.2.2.4 Ethernet – Host/TMS Communications

The Host/TMS Computer System can be connected to the MultiLoad II/ RCU II using Ethernet.

The Ethernet controller on revision 2.0 CPU boards uses HP Auto-MDIX technology. By automatically detecting the signaling on the connected device, the transceiver will configure the port settings automatically. Thus, the choice of a straight through or cross over cable no longer has to be made—either will work.

Ethernet is available on MultiLoad II/RCUII with revision 2.0 or higher CPU boards.

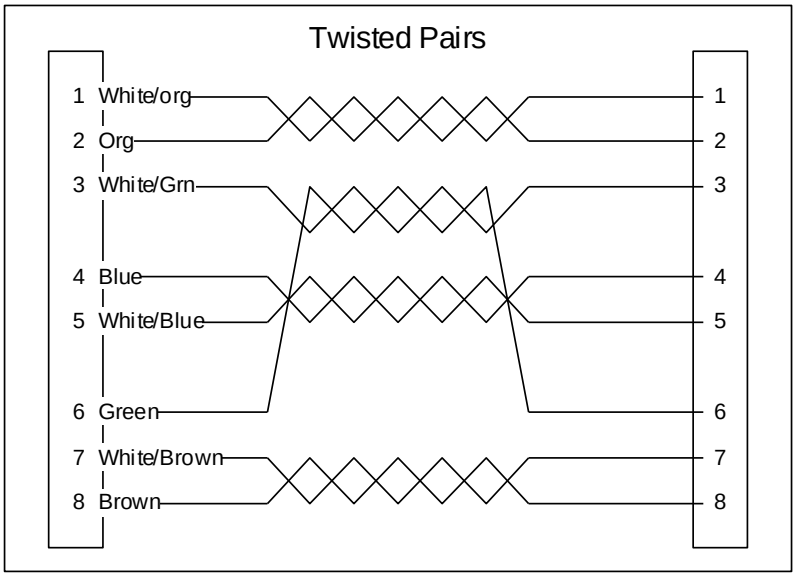


Figure 4.8 Ethernet Connections

4.2.3 Host Ticket Printer/Data Logger

Ticket Printers or alibilog printers can be connected to the MultiLoad II/ RCU II in the following ways:

- RS 232 on COM1
- RS 232 on COM2
- Ethernet on the ethernet port

4.2.3.1 COM2 – RS232 - Host Ticket Printer/Data Logger

A Ticket Printer or Data Logger can be connected to the MultiLoad II/ RCU II via RS232 on COM 2.

The TX and RX are swapped at the MultiLoad II/ RCU II.

Handshake lines MUST be connected or terminated, or a printer error will be reported.

MultiLoad II/ RCU II will monitor CTS, DSR and DCD for active signals.

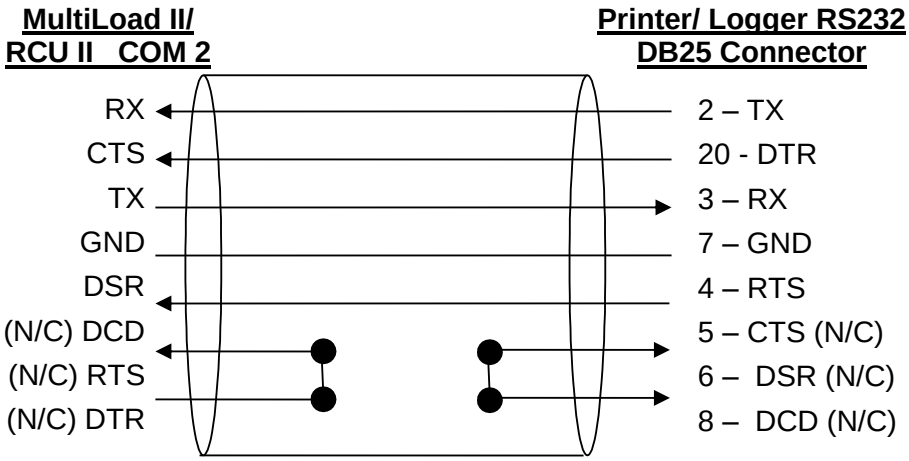


Figure 4.9 Ticket Printer / Data Logger Connections with Handshake

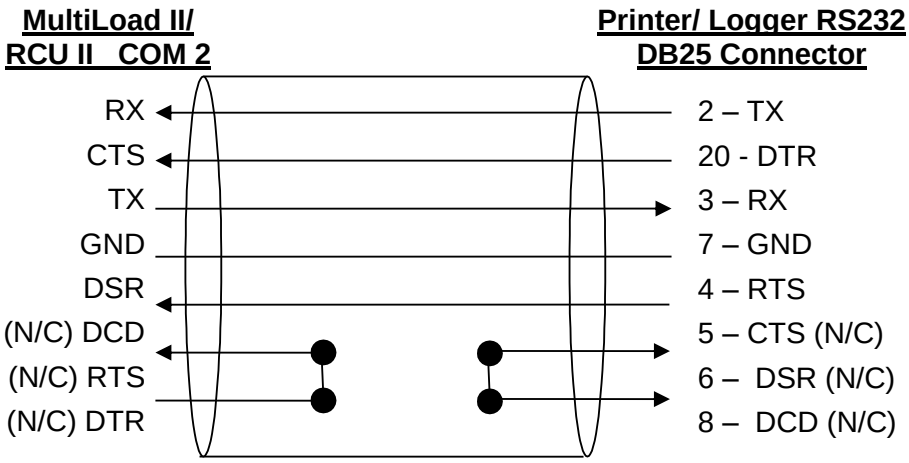


Figure 4.10 Ticket Printer / Data Logger Connections without Handshake

When Print or Alibi Log is configured to be on COM 2, the CTS handshake line MUST be connected, or a printer error will occur, preventing loading.

A Special variant of the ticket printing uses the **PTB protocol.**

A PTB printer can be connected to the MultiLoad II/ RCU *II* via RS232 on COM 2 or COM1:

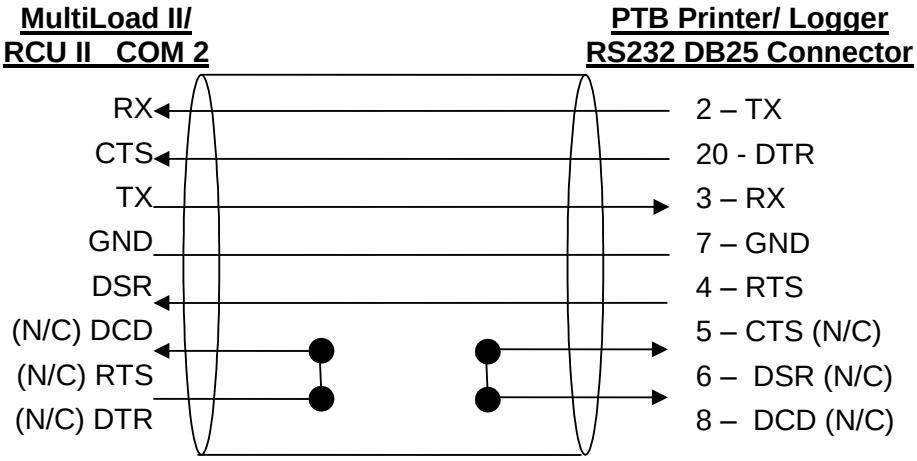


Figure 4.11 PTB Printer Connection with Handshake

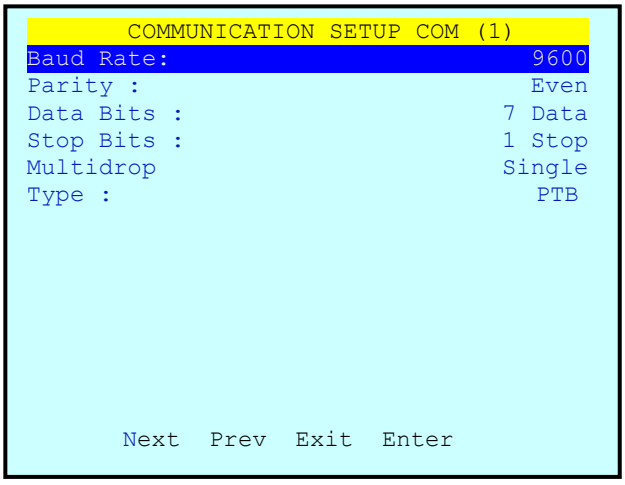


Figure 4.12 PTB Printer Configuration

Chapter 5

Chapter 5 Connecting Field Devices to the I/O Board

Two I/O board options are offered for use with the MultiLoad II. They are the Digital/ Analog I/O Board and the 2 Meter I/O Board. They primarily differ in the number of I/O points, although the latter can control two meters as its name implies. The RCU II only supports the Digital/ Analog I/O Board. Figures 5.1 and 5.2 show the board's terminal arrangements.

The 2 Meter I/O board treats its I/O in two groups corresponding to two different meters. In the 2 Meter I/O wiring diagrams that follow, FCM 0 ports correspond to the first meter and FCM 1ports correspond to the second meter. For more information, please consult the MultiLoad II Users Guide.

5.1 Locating the Internal I/O Board

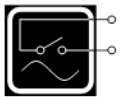
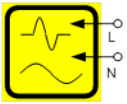
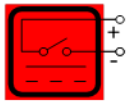
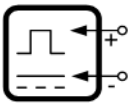
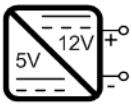
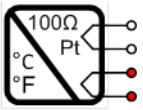
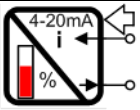
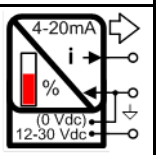
The I/O board is mounted above the Power Supply/Comm board. The I/O board is connected to the Power Supply/Comm board at J4 & J5. Corresponding connections are on the bottom side of the I/O board.

Caution: Disconnect from the supply circuit before opening the enclosure. Keep this tightly closed when circuits are live.

5.2 Available I/O Points per Board

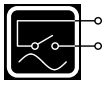
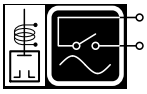
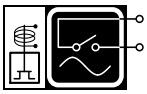
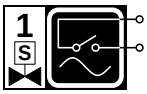
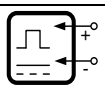
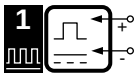
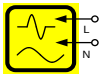
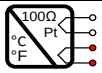
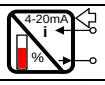
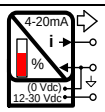
The quantity and electrical ratings of the available I/O points per board are described in the table below.

For easy recognition and use, a circuit symbol corresponding to its' board is located in the last column:

TYPE I/O	DIGITAL/ ANALOG I/O BOARD QUANTITY	2 METER I/O BOARD QUANTITY	ELECTRICAL RATING	CIRCUIT SYMBOL
AC Outputs	5	8	12 - 250 Vac rms, 500 mA (per point), TB1	
AC Inputs	0	2	90 - 250Vac	
DC Outputs	3	2	0 - 30 Vdc, 600 mA (per point), TB3	
DC Inputs	5	6	5 - 30Vdc, TB2B Dual Channel flow meter inputs (1-5000Hz) Miscellaneous signal inputs	
12Vdc Source	167mA Max Load	250mA Max Load	Isolated Power Supply Power for flow meter pulsers or preamp	
RTD Input	1	2	100-ohm platinum, four wire Coefficient 0.00385 Ohm/Ohm/°C	
Analog Input	1	0	4 - 20mA, 1.5V maximum burden	
Analog Output	1	0	4 - 20mA, Requires 12Vdc – 30Vdc Supply	

Certain I/O circuit symbols have dedicated functions, which are described in the table below.

This list is not exhaustive, but contains those most frequently used:

TYPE I/O	CIRCUIT SYMBOL	FUNCTION
AC Output		All AC outputs may be used as line voltage ON/ OFF control.
AC Output		If a digital valve control is used, PORT 2 is dedicated to control the (N.O.) upstream solenoid.
AC Output		If a digital valve control is used, PORT 3 is dedicated to control the (N.C.) downstream solenoid.
AC Output		If an additive injection control is used, the numbered AC output must be paired with the corresponding numbered DC input.
DC Input		All DC inputs may be used as general digital signal inputs.
DC Input		If a product meter pulser is used, PORT 4 is dedicated to the A channel (single or optional quadrature).
DC Input		If a product meter pulser is used, PORT 5 is dedicated to the B channel (of optional quadrature).
DC Input		If an additive injection control is used, the numbered DC input must be paired with the corresponding numbered AC output.
AC Input		All AC inputs may be used as line voltage digital inputs (typically permissives).
DC Output		All DC outputs may be used as general digital outputs.
RTD Input		The RTD input is reserved for MultiLoad temperature compensation.
4-20 mA Analog Input		The analog input can be used with configurable MultiLoad inputs such as density, pressure, or temperature.
4-20 mA Analog Output		The analog output can be used with configurable MultiLoad outputs such as Analog Control Valve or Analog Pump.

5.3 Terminal arrangements per Board

5.3.1 Digital Analog I/O Board (IO_DA)

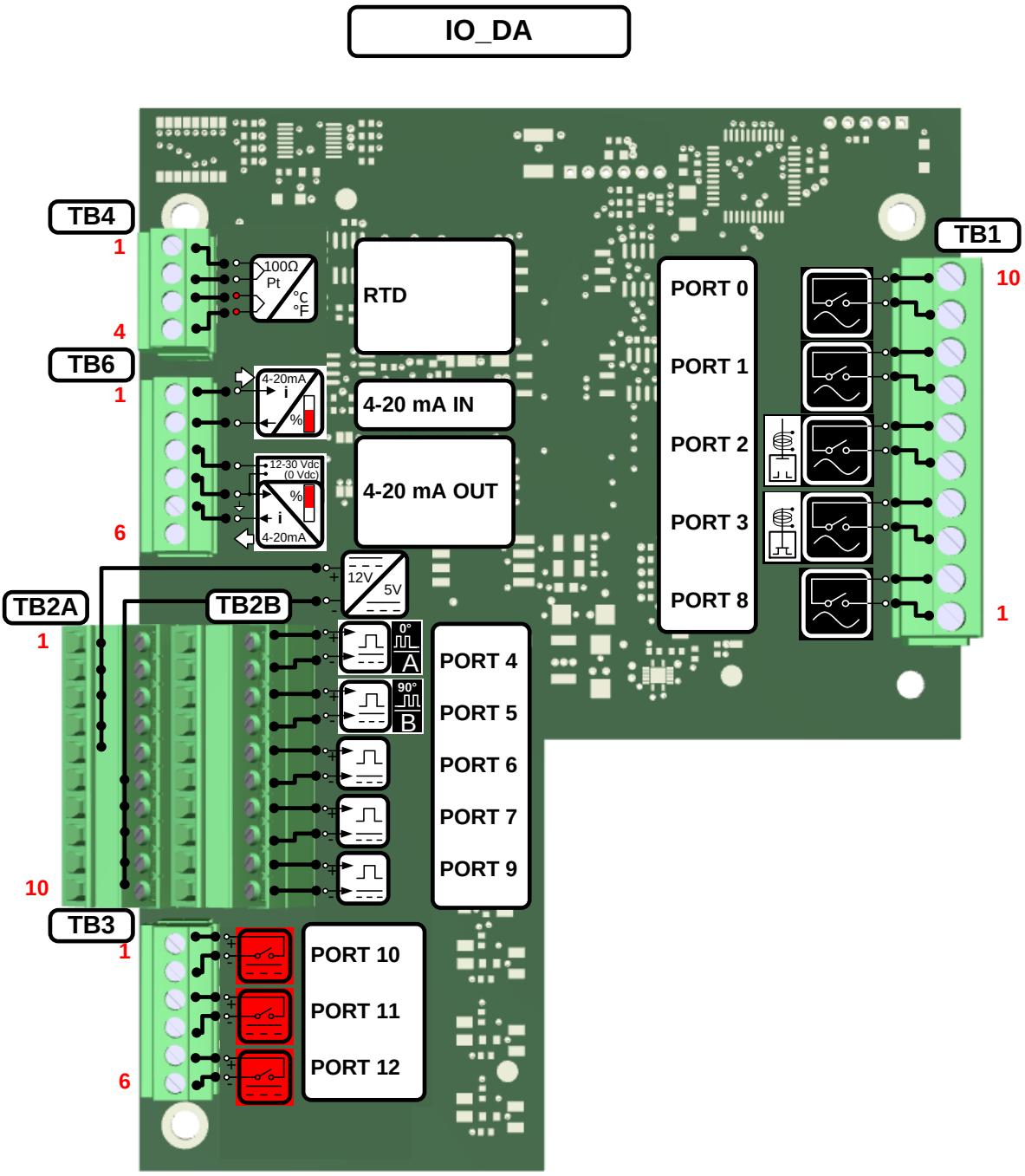


Figure 5.1 Digital/ Analog I/O Board Terminal Block Assignments

5.3.2 2 Meter I/O Board (IO-2M)

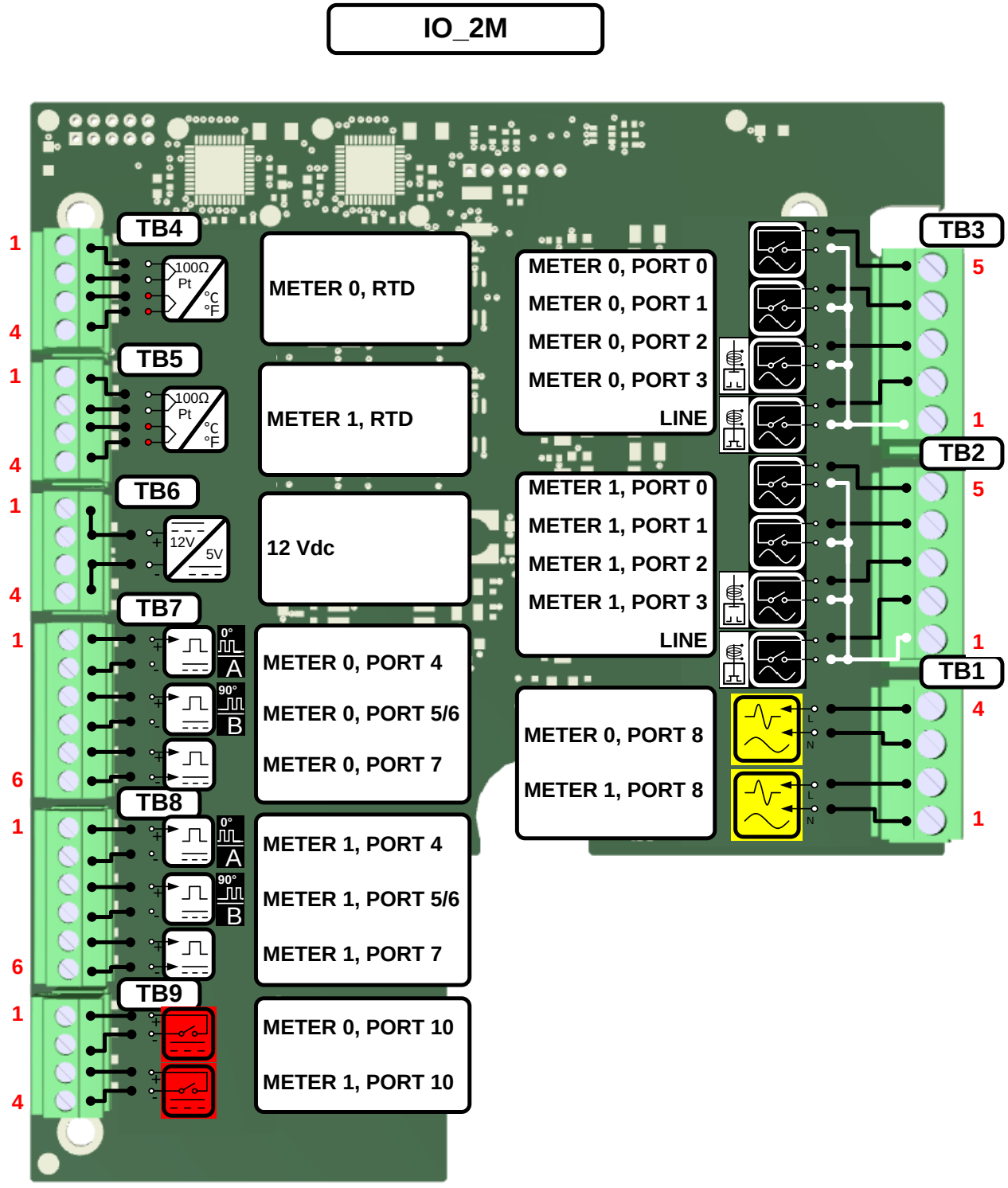


Figure 5.2 2 Meter I/O Board Terminal Block Assignments

5.4 How to Connect and Wire Field Devices to the I/O Boards

In this section of the chapter we will provide examples of commonly used devices that can get wired to the I/O boards. This is not an exhaustive listing, but intended to provide you an example of how certain types of I/O need to get wired into the various boards.

MultiLoad II Wiring Examples:

- Flow Meter and Control Valve
- Additive
- RTD
- Analog In & Analog Out
- AC Output Wiring
- AC Input Wiring
- DC Input Wiring: Permissives/Status
- DC Output Wiring
- 2 Output Air Eliminator Wiring
- Remote Display Wiring

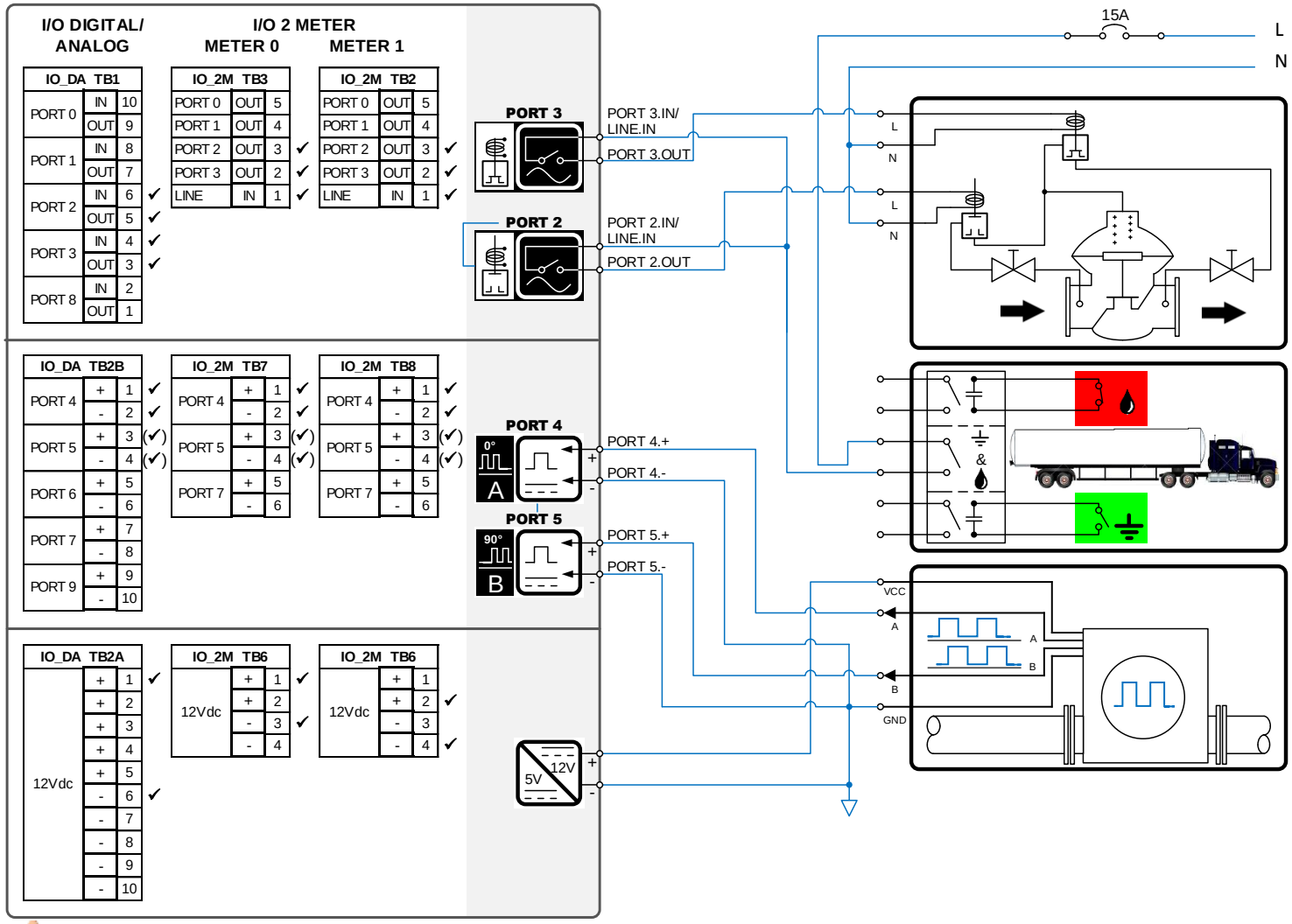
RCUII Wiring Examples:

- DC Input Wiring
- AC: DC Output wiring

Typical Example:

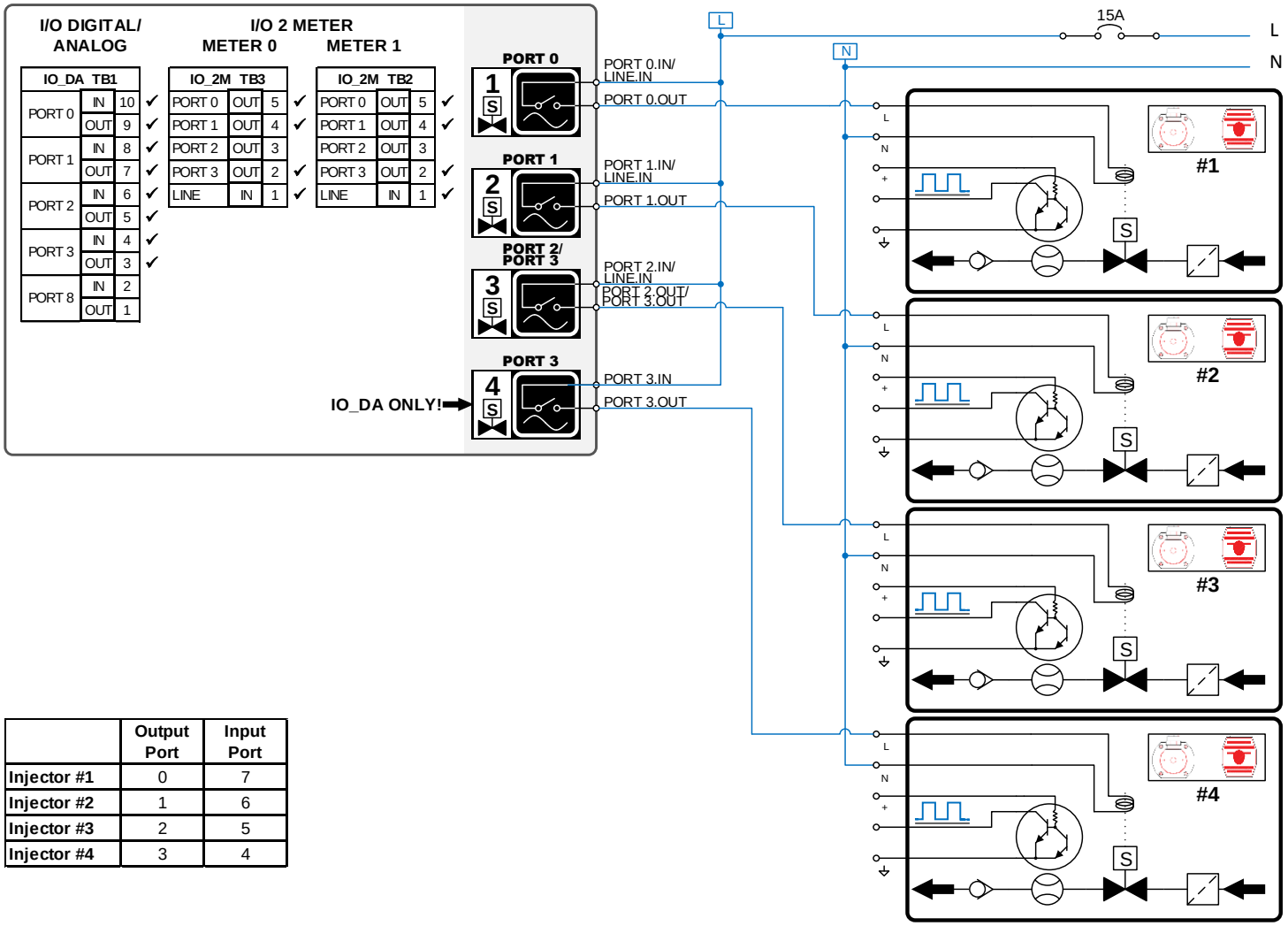
- Typical single meter example

5.4.1 MultiLoad II Flow Meter and Control Valve Wiring



Caution: Line voltage used to drive the Digital Valve Solenoids MUST be controlled by the Ground or Overfill monitor. In the event of a Ground loss or Overfill detection, this voltage must be switched off to ensure a failsafe shutdown of the product flow.

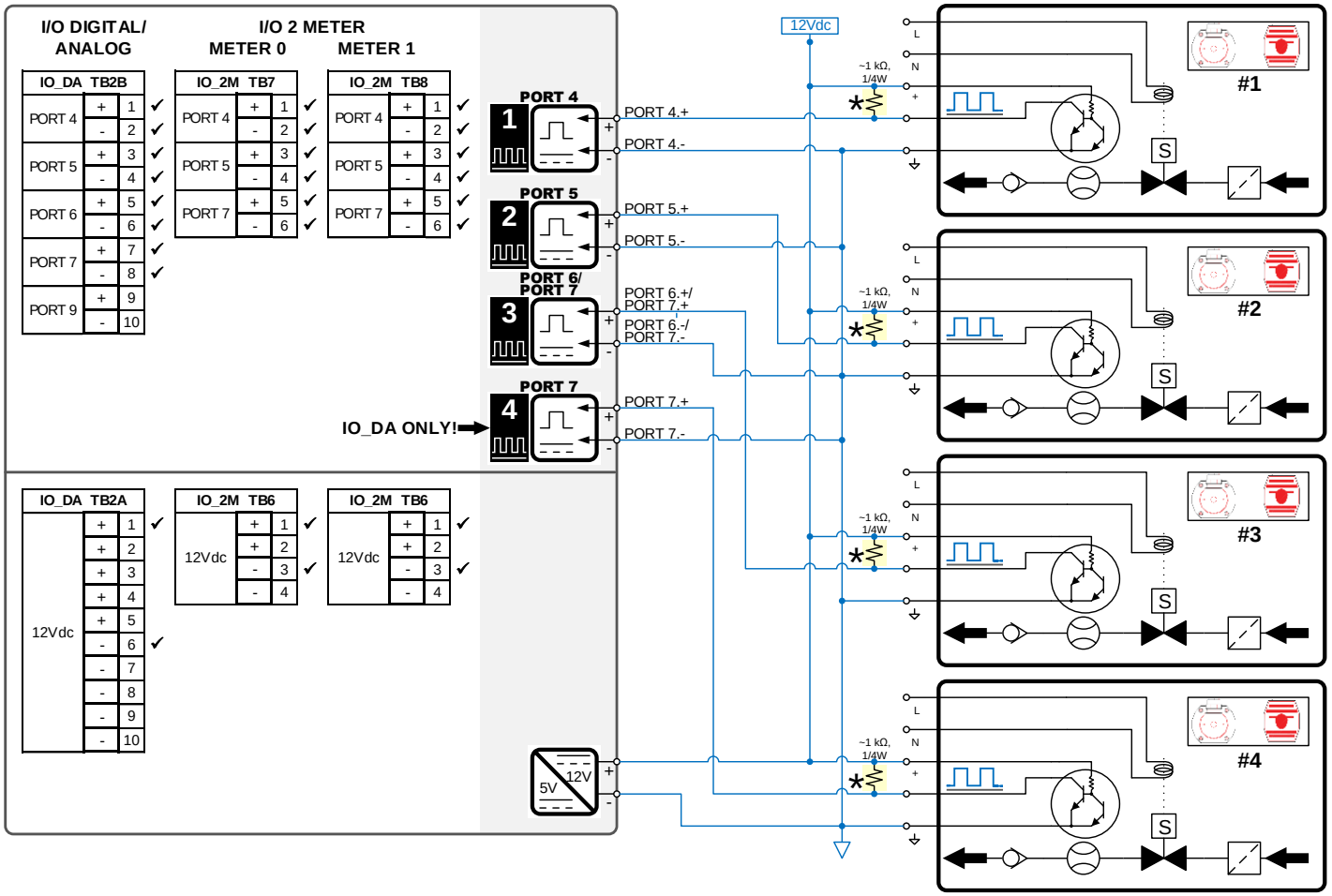
5.4.2 MultiLoad II Additive Wiring: Outputs



	Output Port	Input Port
Injector #1	0	7
Injector #2	1	6
Injector #3	2	5
Injector #4	3	4

Note: The output port that is selected will dictate which port is used for the additive input. For example, if Port 0 is selected as the FCM Port#, the output will be on port 0 and the corresponding input will be at port 7. See Table above for possible port assignments.

5.4.3 MultiLoad II Additive Wiring: Inputs

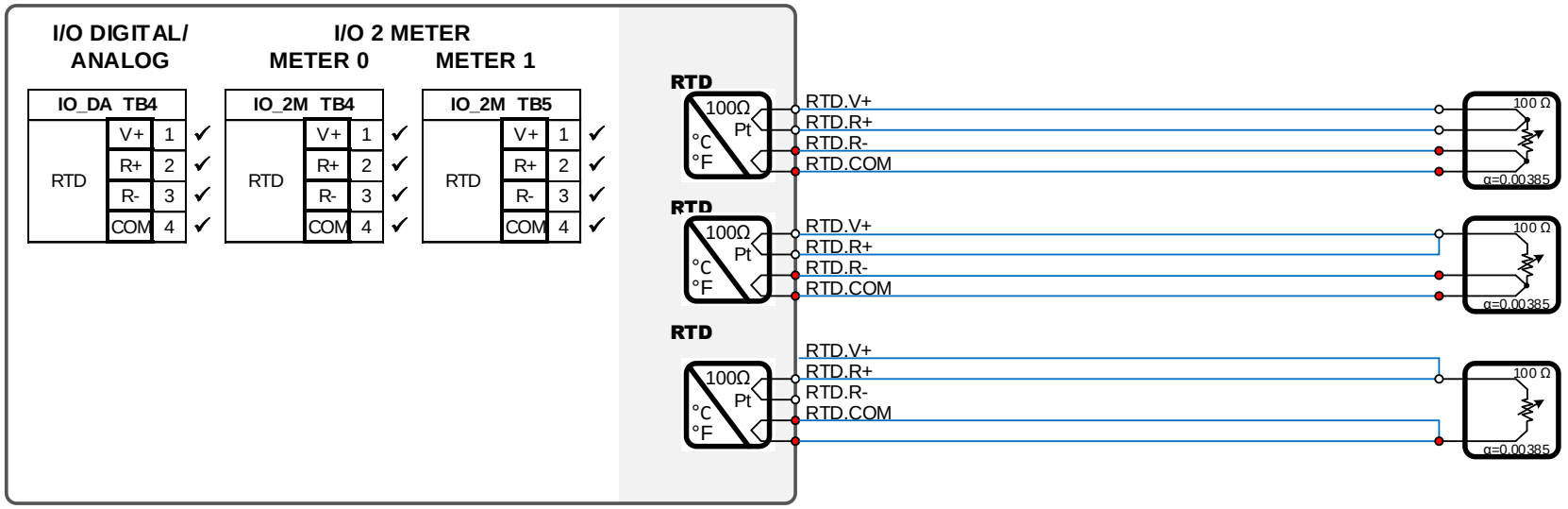


***Note:** Most additive injection meters only provide an Open-Collector (pull down) type output. Typically a 1,000 Ohm, ¼ watt pull-up resistor needs to be added in the pulser junction box to pull this output to 12V+ when the output is off.

Note (I/O 2 METER Only): TB7 pins 3 and 4 can be configured as Port 5 or Port 6. It is only 1 port, but because of the logic in the firmware, it may be necessary to address it as Port 5 or Port 6 in the configuration.

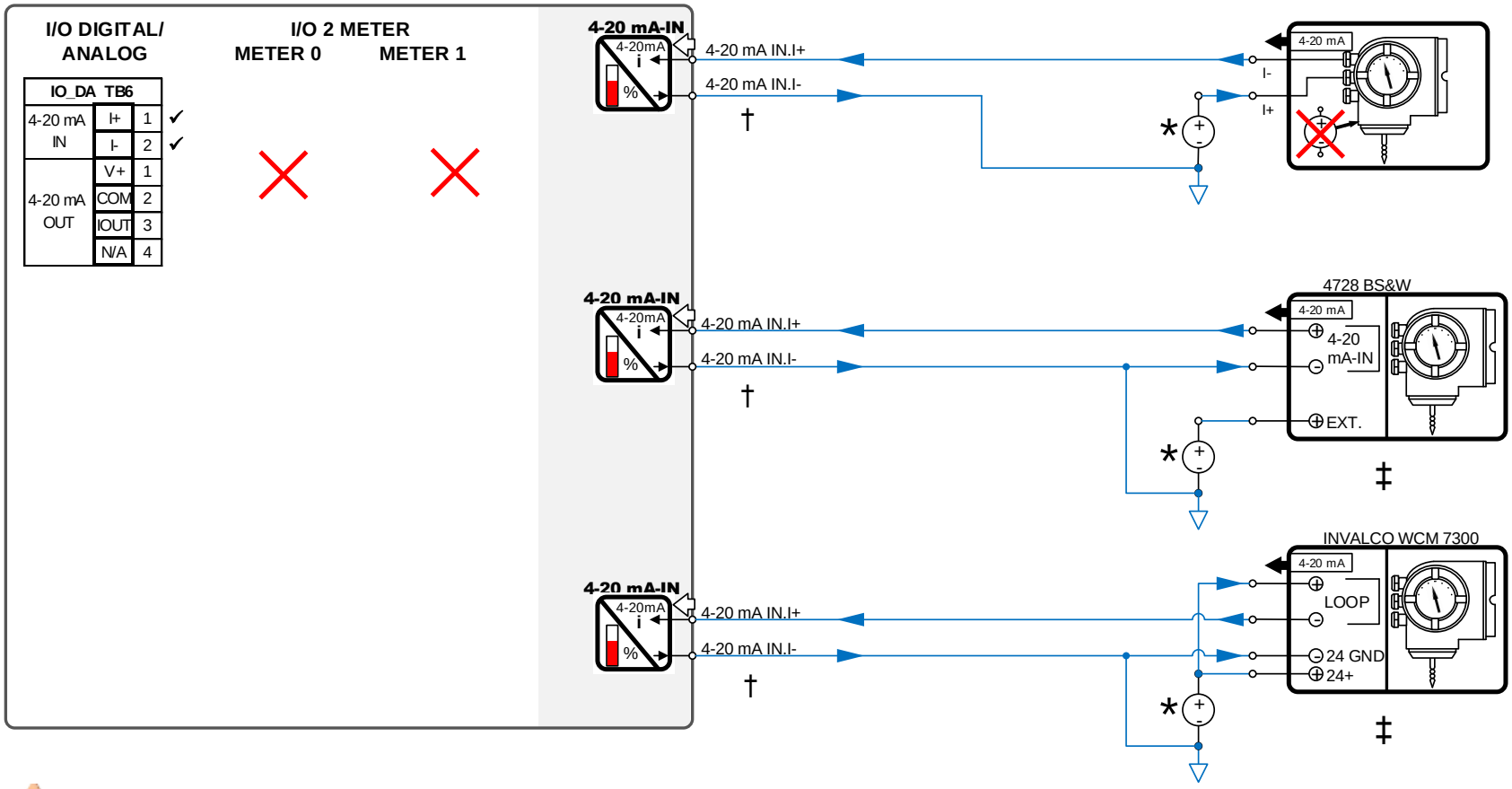
5.4.4 MultiLoad II Analog Wiring

5.4.4.1 RTD Wiring



Note: All 4 wires MUST be run to the sensor. Do not simply jumper REF- to COM or REF+ to V+ at the FCM II. For 3-wire and 2 wire probes, the connection of REF- to COM and REF+ to V+ should be as close as possible to the probe (within inches).

5.4.4.2 MultiLoad II 4 – 20 mA Input Wiring

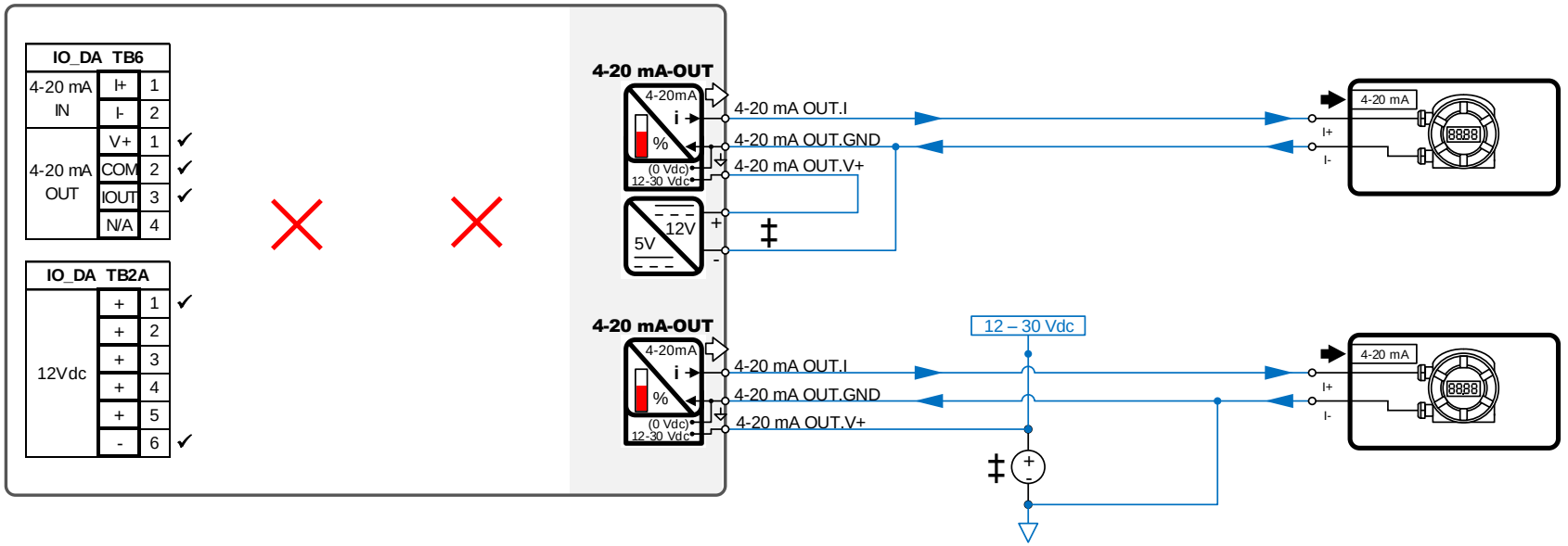


*** Note:** The 4-20 mA receiver does not contain a voltage source. The loop must be powered either by the transmitter or by an external power supply. The I/O Board adds 75 Ohms to the loop.

† Note: "4-20 mA IN.I-" MUST CONNECT TO LOOP SUPPLY- !

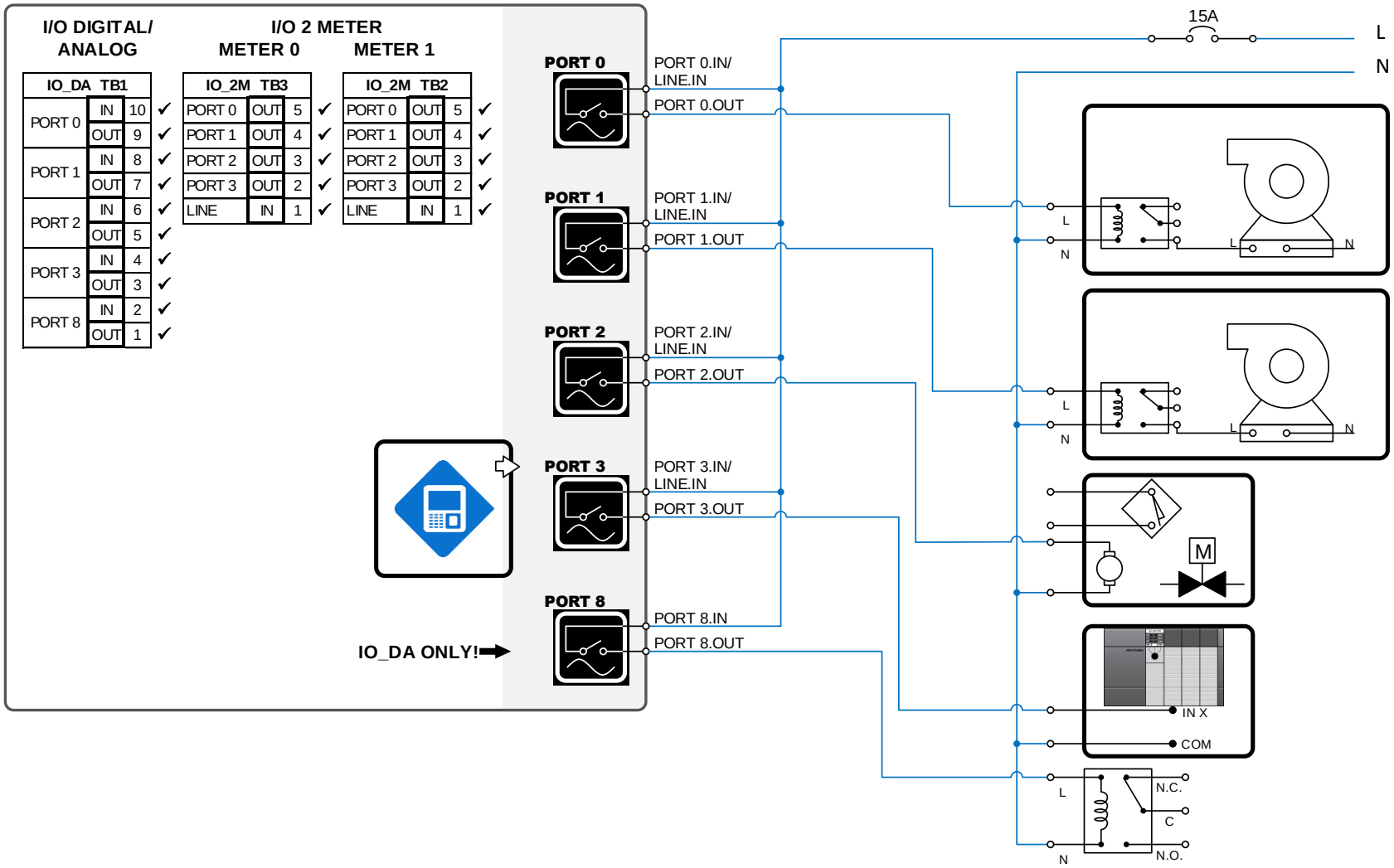
‡ Note: A separate supply powers the transmitter. 4-20 mA IN.I+ must be connected to the transmitter's current output.
DO NOT CONNECT "4-20 mA IN.I+" TO LOOP SUPPLY+ !

5.4.4.3 MultiLoad II 4 – 20 mA Output Wiring



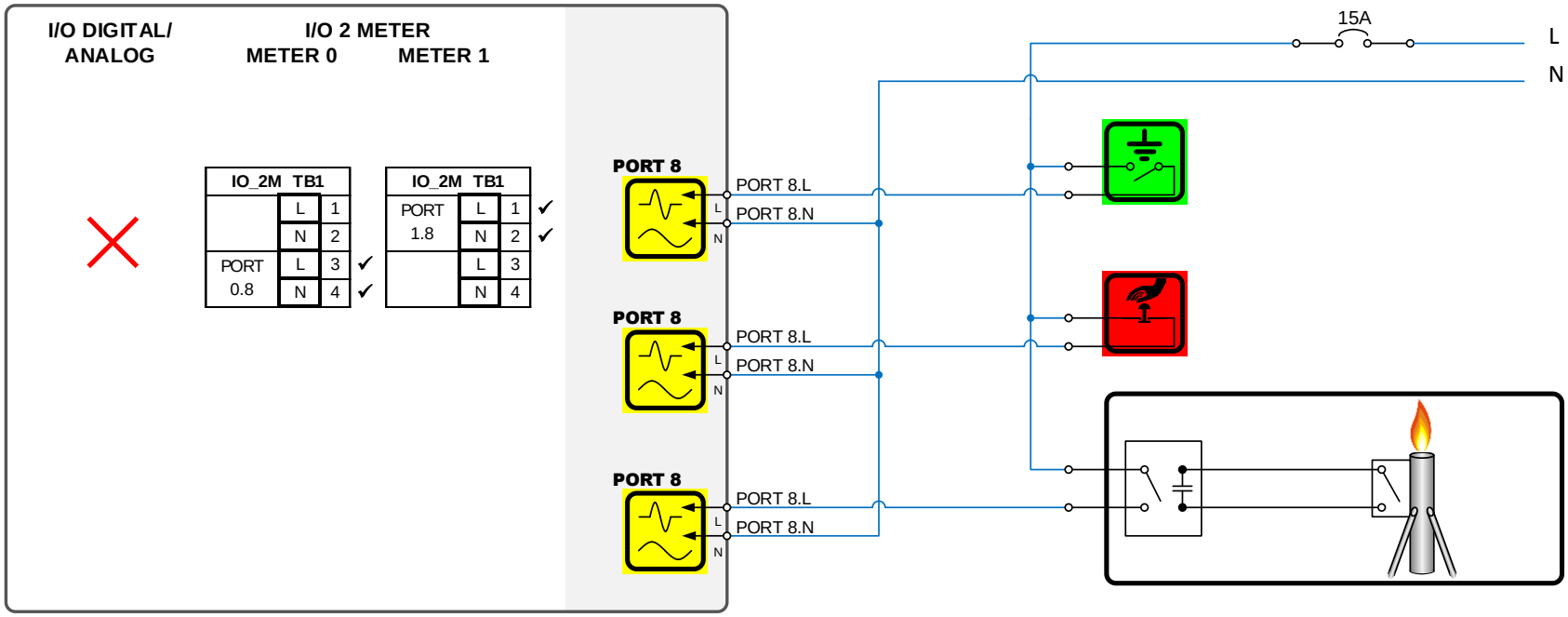
‡ **Note:** The 4-20mA output requires a power source (12-30vdc). The 12vdc output can be used as shown here.

5.4.5 MultiLoad II AC Output Wiring



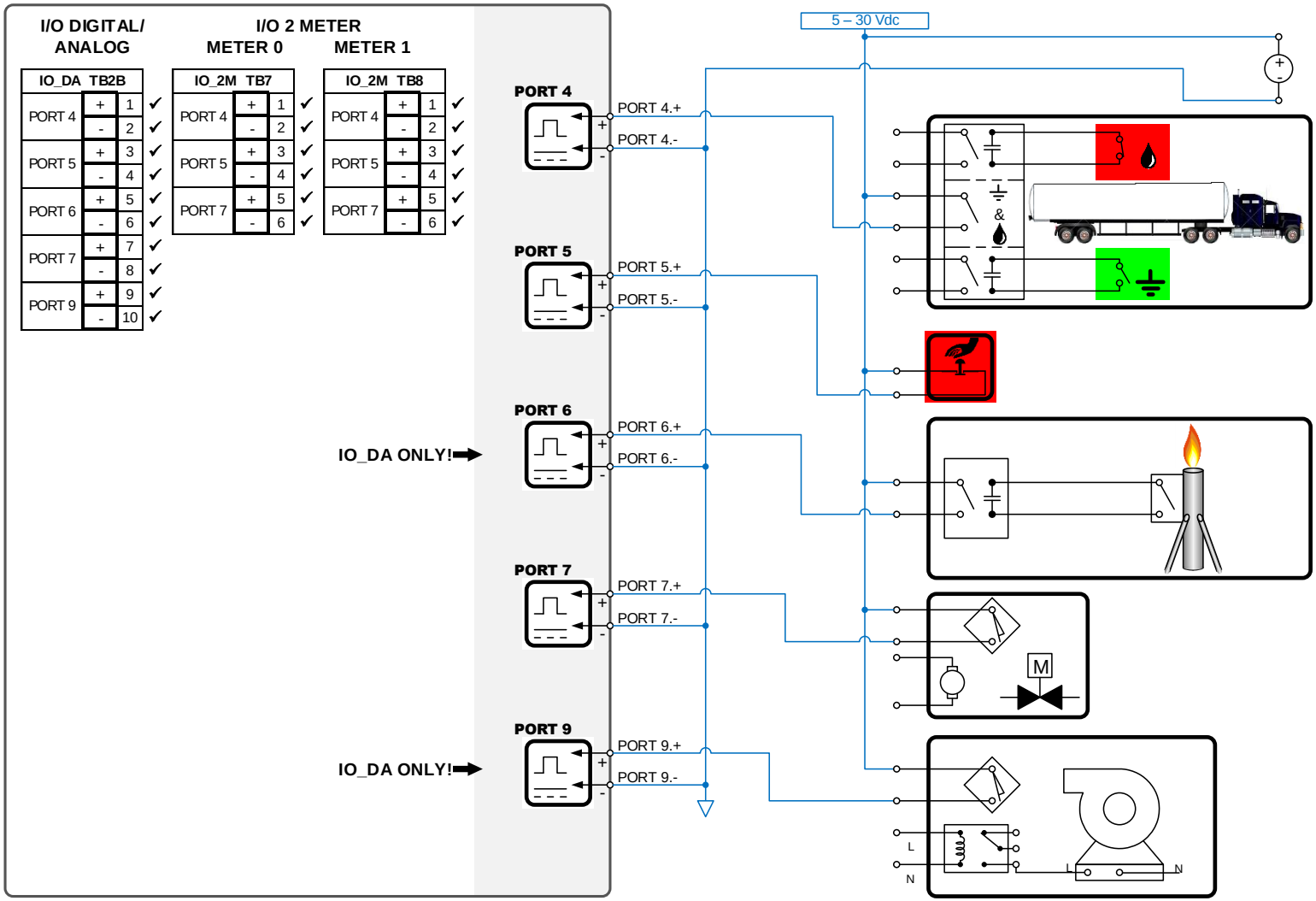
Note: This shows a typical configuration. AC outputs can be assigned to any unused AC output.

5.4.6 MultiLoad II AC Input Wiring



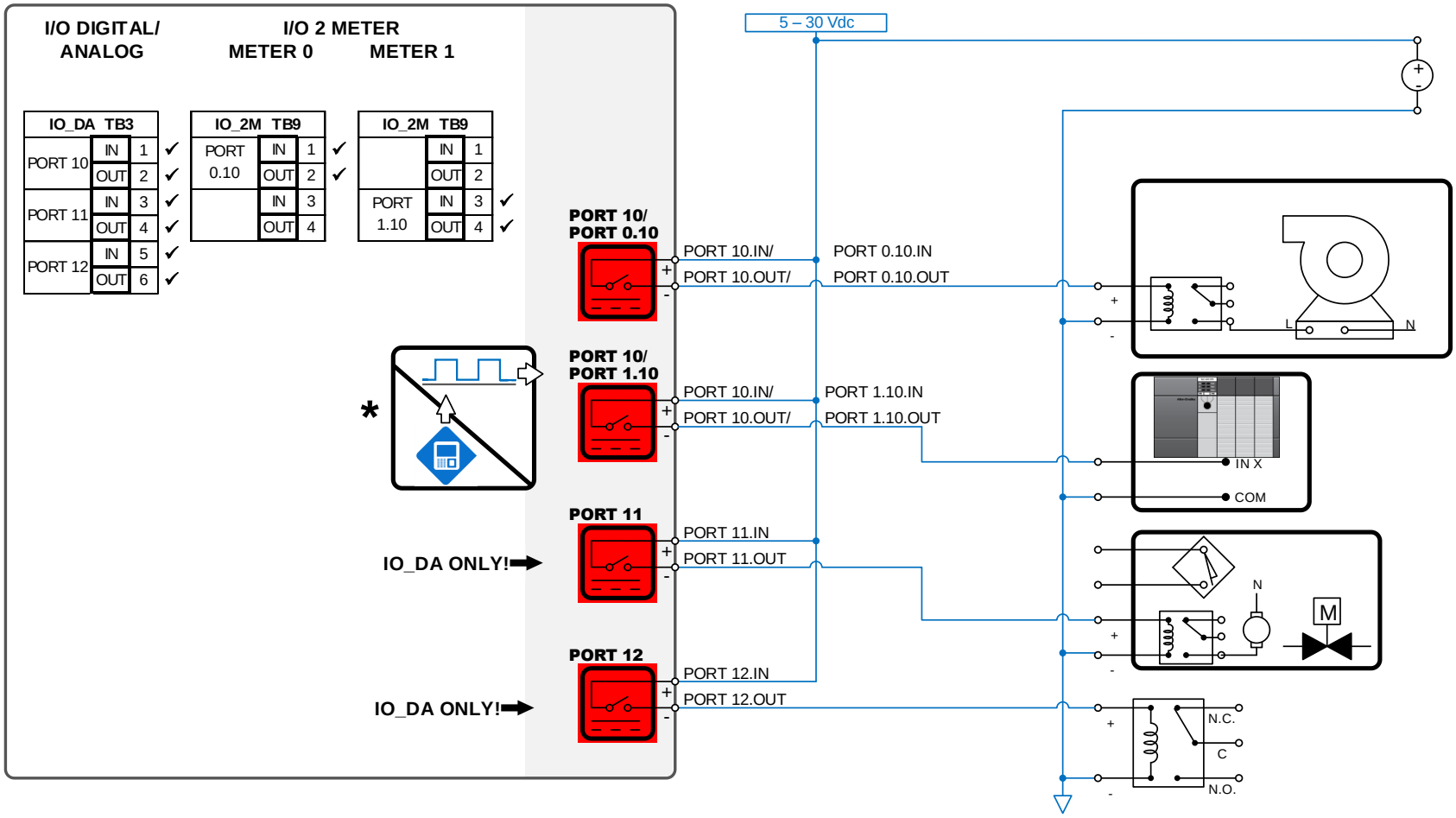
Note: This shows a typical configuration. AC Permissive/Status inputs can be assigned to any unused AC input.

5.4.7 MultiLoad II DC Permissive/Status Wiring



Note: This shows a typical configuration. DC Permissive/Status inputs can be assigned to any unused DC input.

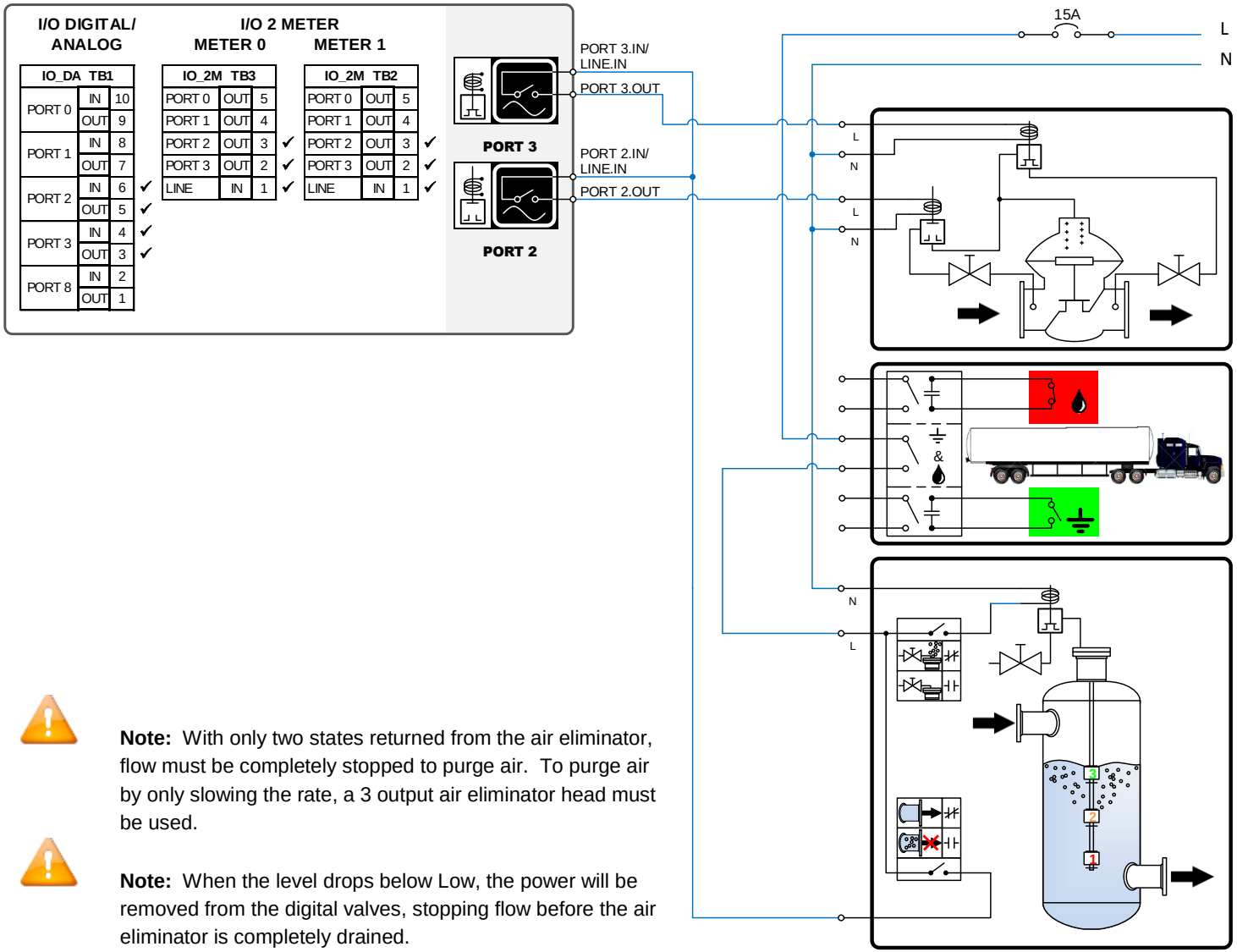
5.4.8 MultiLoad II DC Output Wiring



Note: This shows a typical configuration. DC outputs can be assigned to any unused DC output.

***Note:** For I/O Board firmware v036 or greater, any DC output port can be configured as an output pulse.

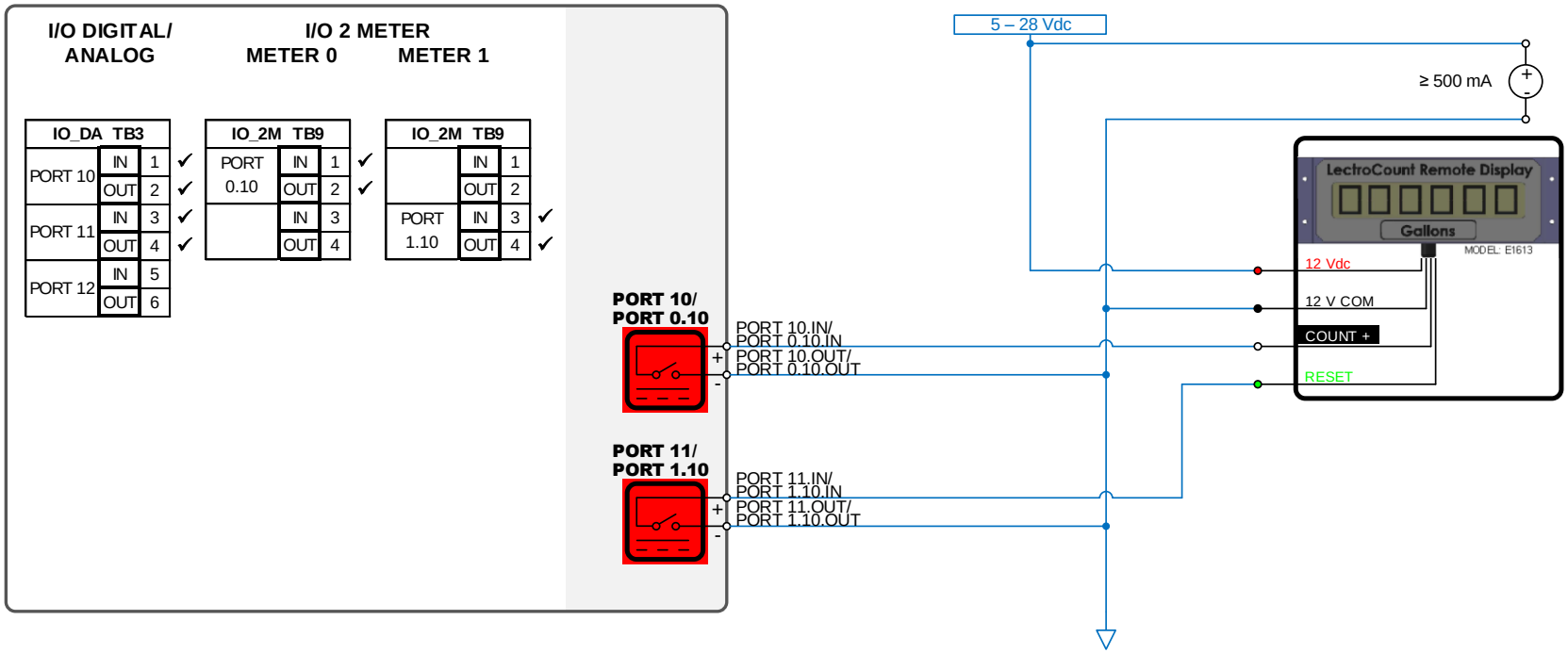
5.4.9 MultiLoad II 2 Output Air Eliminator Wiring



Note: With only two states returned from the air eliminator, flow must be completely stopped to purge air. To purge air by only slowing the rate, a 3 output air eliminator head must be used.

Note: When the level drops below Low, the power will be removed from the digital valves, stopping flow before the air eliminator is completely drained.

5.4.10 MultiLoad II Lectro Count Remote Display Wiring

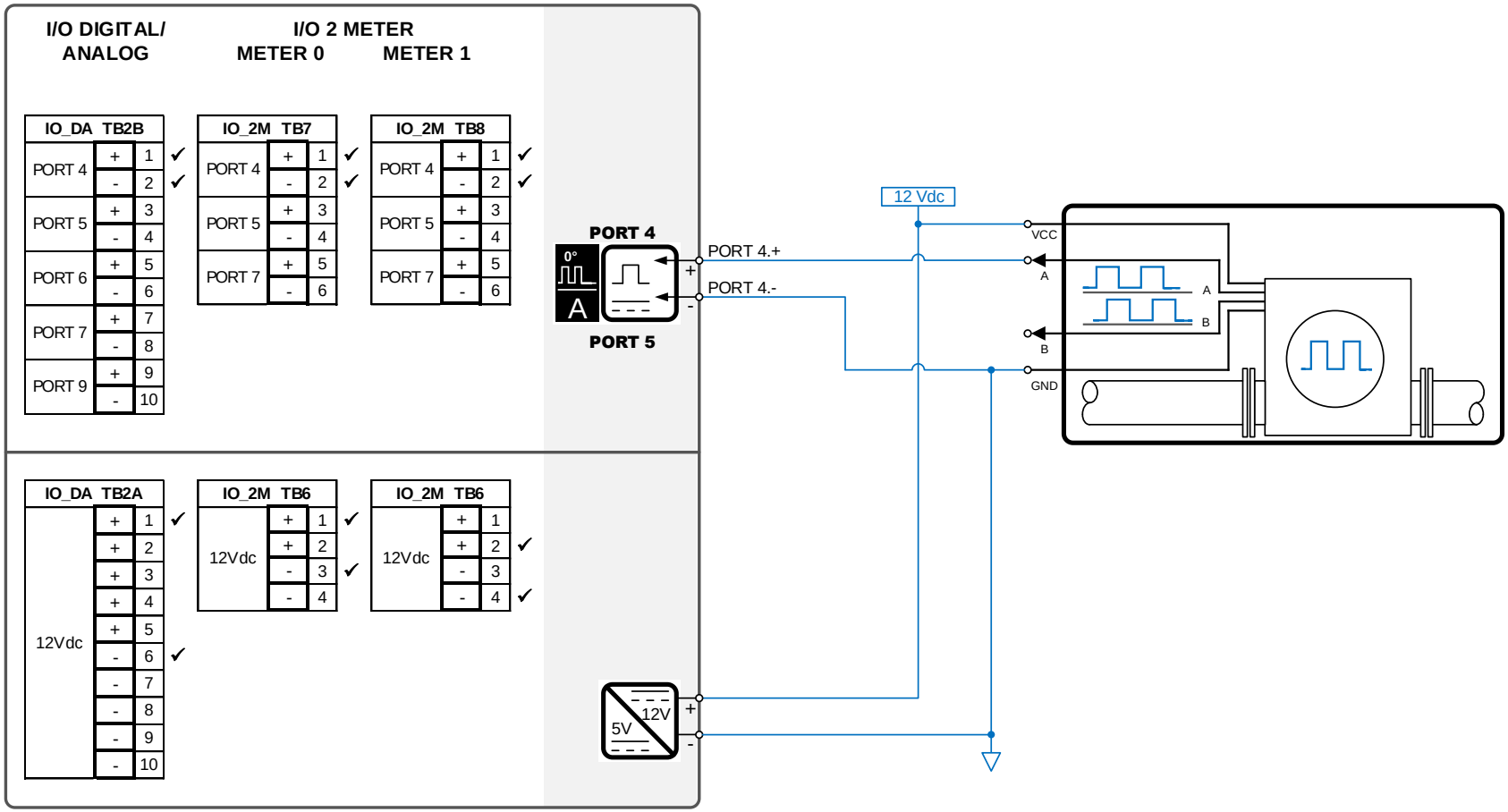


Note: Use only model E1613. The Lectro Count +12Vdc, 12V common can be supplied by an external source.

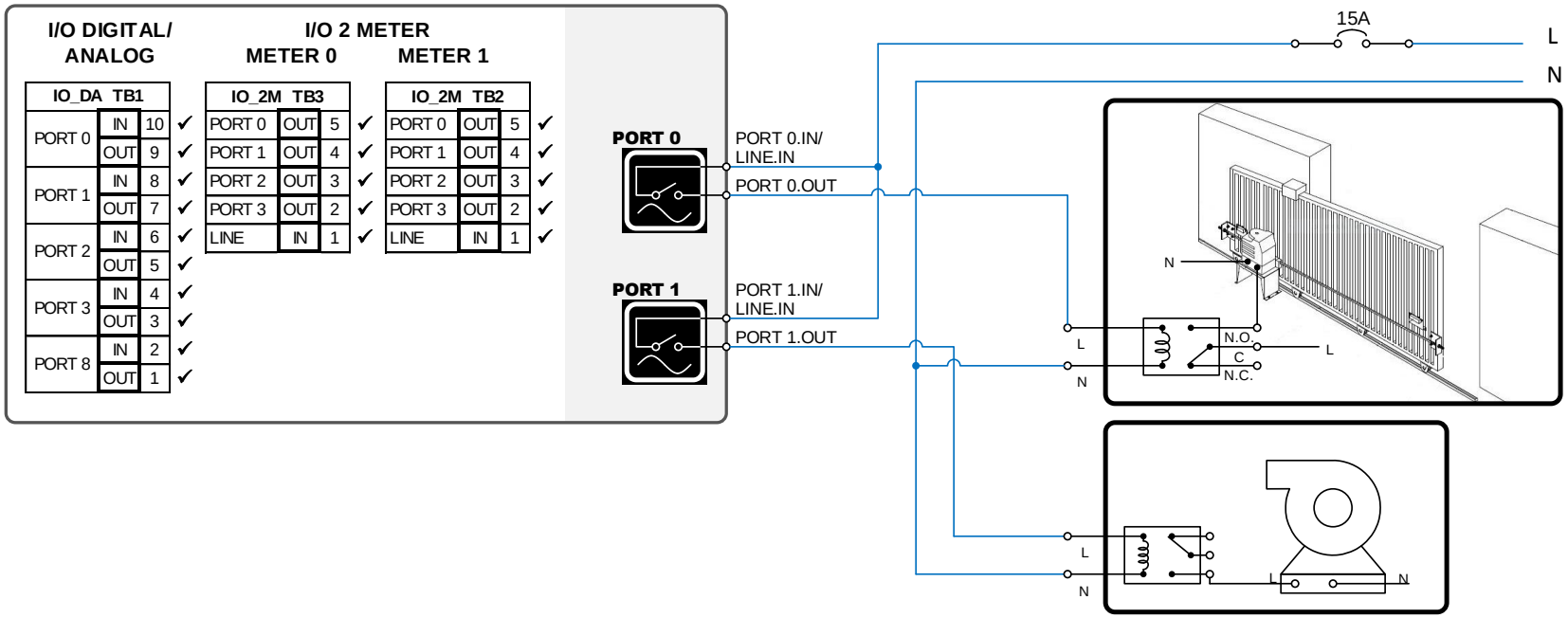
Note (I/O DIGITAL/ ANALOG Only): Connect Port 10 to Lectro Count output pulse. Connect Port 11 to Lectro Count reset pulse.

Note (I/O 2 METER Only): Connect Port 0.10 to Lectro Count output pulse. Connect Port 1.10 to Lectro Count reset pulse.

5.4.11 RCU II DC Input Wiring

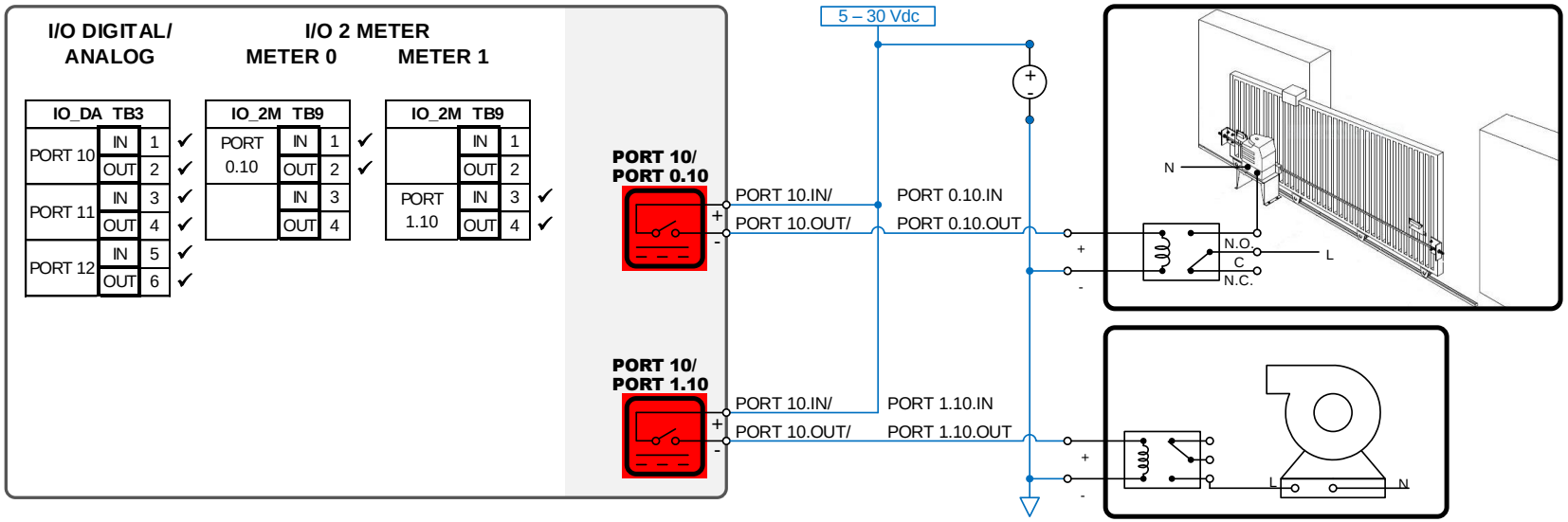


5.4.12 RCU II AC Output Wiring



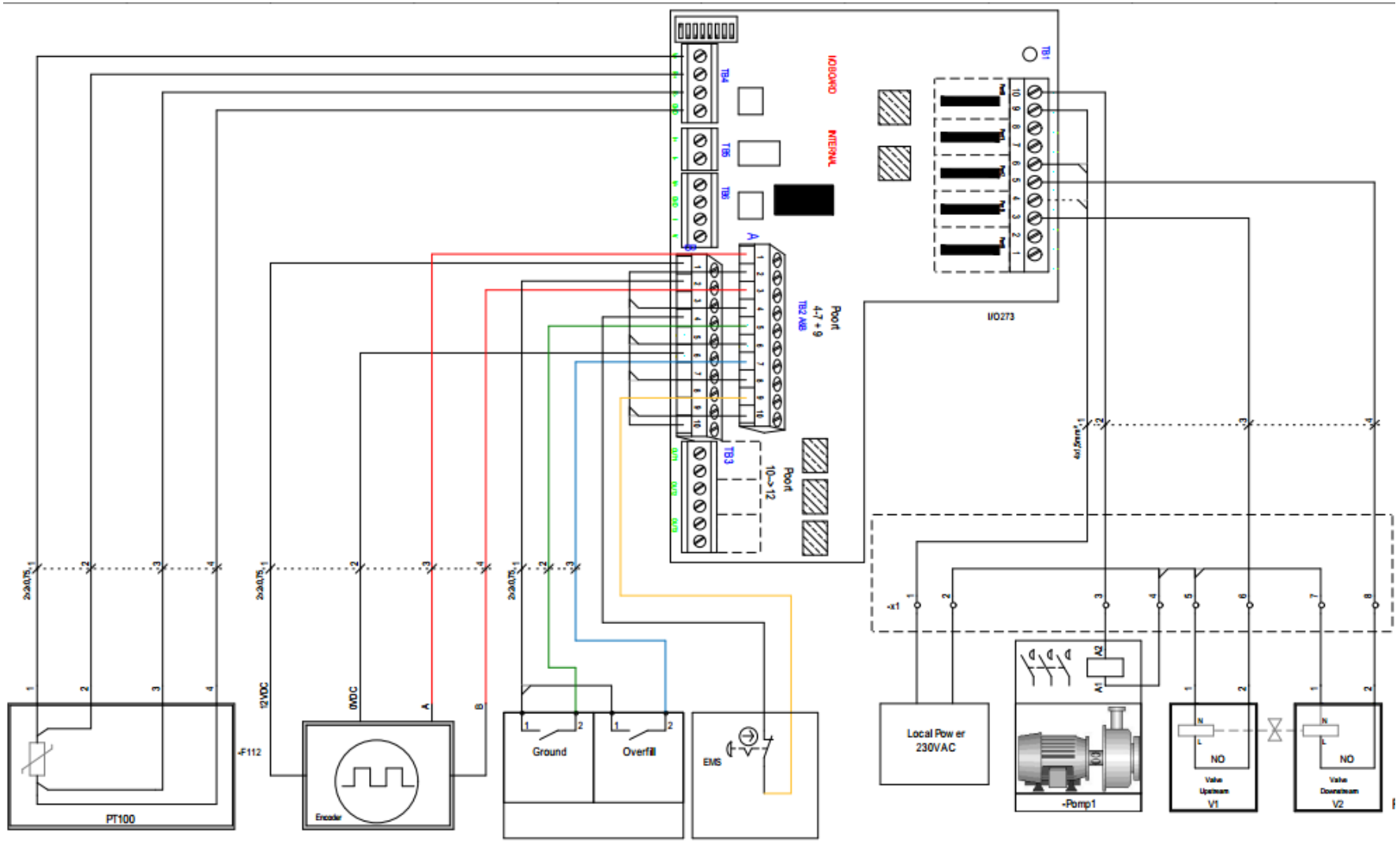
Note: This shows a typical configuration. AC outputs can be assigned to any unused AC output.

5.4.13 RCU II DC Output Wiring



Note: This shows a typical configuration. DC outputs can be assigned to any unused DC output.

5.4.14 Typical 1 Meter Application Wiring Example: IP&E Drawing (Electrical Wiring Schedule)



Chapter 6

Chapter 6 Configurations

6.1 Switch Access Control

The MultiLoad II contains switches which limit menu and configuration access. These switches limit users from accessing Program Mode, as well as from changing Weights and Measures controlled parameters.

In Program Mode, the operator has access to the following:

- The Configuration Menu parameters.
- The Diagnostics Menu and its functions.
- Other administrative procedures, such as clearing high-level alarms.

To access Program Mode, the MultiLoad II/ RCU II terminal operator must:

1. Move the Program Mode switch into the active position.
2. At the idle card-in screen, enter the security code (default security code is 000000) and press the **Next** key.

6.1.1 External Switch Access Control (MultiLoad II Only)

One access control switch option is a pair of external access control switches. These switches limit access to Program Mode and changes to Weights and Measures controlled parameters.

EXTERNAL SWITCHES SERVE NO FUNCTION ON THE RCU II SINCE PASSWORD ACCESS ALWAYS OVERRIDES THE PROGRAM SWITCH SETTING. WEIGHTS AND MEASURES FUNCTIONALITY IS UNDEFINED FOR THE RCU II.

YOUR LOCAL WEIGHTS AND MEASURES OFFICE MAY NEED TO BE CONTACTED AFTER BREAKING THE SEAL AND CHANGING PARAMETERS. THIS IS TYPICALLY DONE ONLY DURING METER PROVING OR TEMPERATURE CALIBRATION.

Depending on the date of manufacture, the MultiLoad II may have one of three types of external switch design. All can be sealed and locked to prevent access to Program Mode and to prevent changes of Weights and Measures controlled parameters.

6.1.1.1 Magnetic Bolts Program / W&M Switches (current)

This design is the most current and can be found on all new units. This design consists of two separate external magnetic bolts, one for Program Mode Access, and one for W&M change access. Program or W&M access is achieved by removing the corresponding bolt. Each bolt has a small hole that can be sealed with a wire and lead seal to detect unauthorized access. A single fold--down cover can be locked to prevent bolt removal. The cover is marked “W&M” or “Program” adjacent to each bolt to indicate the bolt function.

Figure 6.1 Type 3 Program / W&M Switch with Magnetic Bolts

Do not use a wrench to tighten the bolts. Insert the bolts and hand tighten only. Over-tightening will damage the bolt assembly.**Two (2) Rotary Program / W&M Switches (obsolete)**

This design consists of two separate external rotary switches: one for Program Mode Access, and one for W&M Change Access. Each switch has an external fold-down cover that can be locked or sealed with a wire and lead seal to prevent moving the switch into the active state. Each cover will also be stamped as “W&M” or “Program” to indicate their respective function.

Figure 6.2 Type 1 Program / W&M Switches

6.1.1.3 Single Rotary Program / W&M Switch (obsolete)

This design consists of a single 3-position external rotary switch with two individual covers which may be locked and sealed with a wire and lead seal. The covers limit the switch rotation to three positions:

A - Two covers closed: Program access is denied and Weights and Measures access is denied.

B - First cover open: Program access is allowed and Weights and Measures access is denied.

C - Both covers open: Program access is allowed and Weights and Measures access is allowed.

Figure 6.3 Type 2 Program / W&M Switches

6.1.2 Internal Switch Access Control

Two DIP switches on the CPU board also provide the closure of the program mode / W&M switch contacts. When the MultiLoad II/ RCU II does not have the external Program Mode / W&M switch installed, it is necessary to use these DIP switches on the CPU board to enable program mode and W&M access.

The switches are numbered 1 through 4, with 1 being closest to the front of the enclosure (top of the picture), and 4 being towards the back of the enclosure (bottom of the picture).

When the switch is in the ON position, the switch is in the active state, allowing access. A switch is ON when it moves right, and OFF when moved to the left.

Switch #3 is the program mode switch. Switch #4 is the W&M access switch. In the example in Figure 6.4 below, the program mode switch is currently active, while the W&M switch is not active. Figure 6.5 shows the location of the DIP switch on revision 2.x CPU boards.

A switch input is active when either the DIP switch OR the external switch is active (ON).

Figure 6.4 CPU DIP Switches for Program and W&M Access (rev 1.0)

Figure 6.5 CPU DIP Switches for Program and W&M Access (rev 2.x)

6.1.3 Field Switch Access Control

The MultiLoad II also has the ability to accept field inputs for the program mode and W&M access switches. Review the "MultiLoad II User Guide" for more information.

RCU II INPUTS RECEIVED FROM EXTERNAL FIELD DEVICES CANNOT BE CONFIGURED TO CONTROL PROGRAM MODE ACCESS. WEIGHTS AND MEASURES FUNCTIONALITY IS UNDEFINED FOR RCU II.

6.2 MultiLoad II/ RCU II DIV-2 Keypad

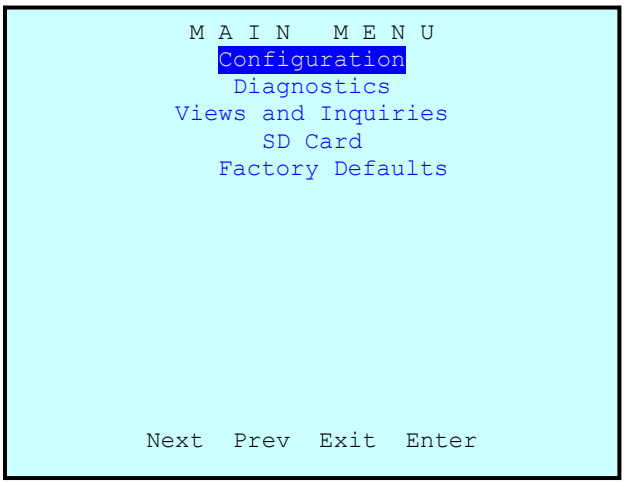
The MultiLoad II/ RCU II EXL keypad has 22 keys, including alpha/numeric and function keys, used to:

- Select menu items and fields
- Enter data in fields
- Initiate actions
- Return to previous screens

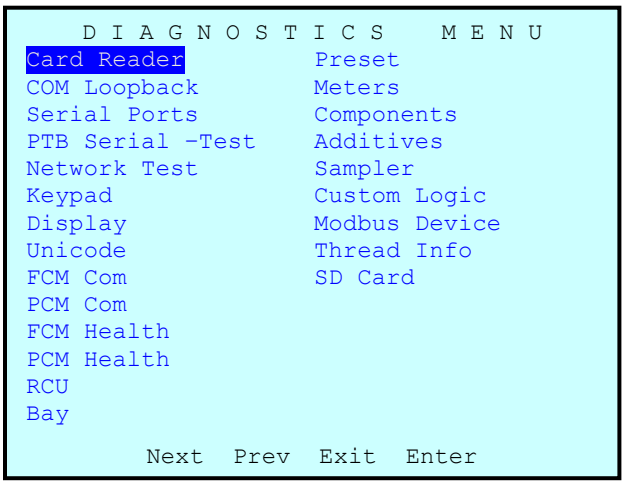
Numeric keys (**1** through **9** and **0**) are used to enter numeric data. Alpha keys are used to enter text, and also to select/deselect alpha character entry. The **CLR** key is used to clear data entered in error; this is a backspace key erasing characters as the cursor moves backwards.

6.3 Menus and Screens

The MultiLoad II Main Menu is shown below. From this menu, you select submenus:



The reverse video highlight bar indicates the current selection. Press **Next** to select Diagnostics, and then press the **Enter** key to go to the Diagnostics Menu.

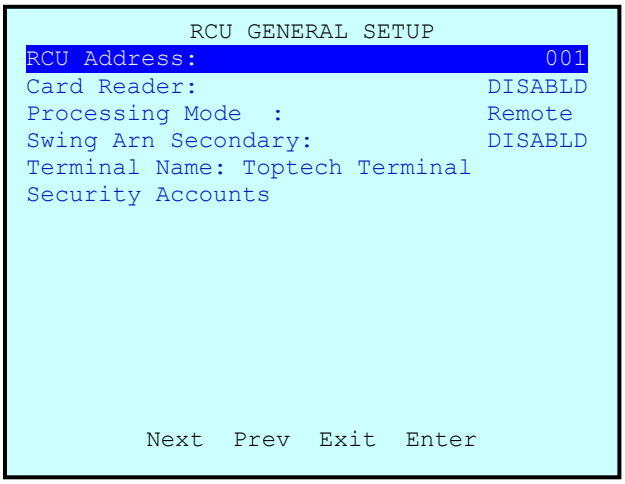


For menu options and function screen items, pressing the **Next** key moves the selection bar down, and pressing the **Prev** (Previous) key moves the selection bar up.

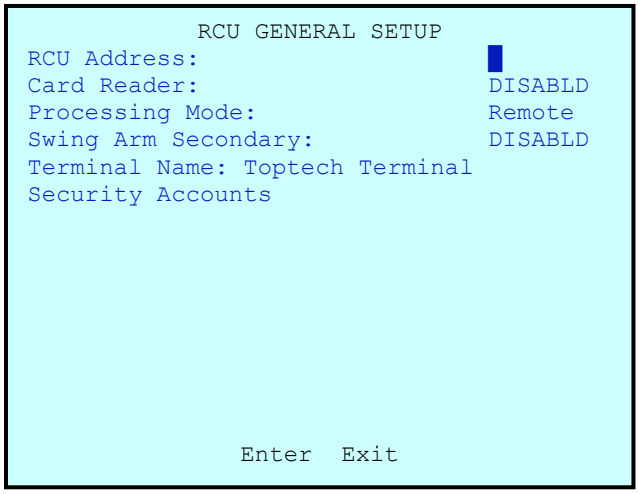
To return to the Main Menu, press **Exit**. To return to any previous screen, press the **Exit** key.

6.4 Field Modification and Data Entry

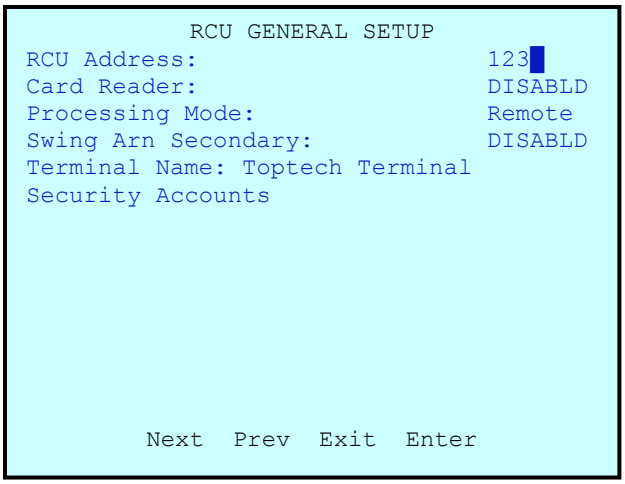
MultiLoad II/ RCU II will have all fields populated with default values. There are two types of fields, toggle or data entry. Toggle fields contain a number of choices. Scroll through the choices by pressing the **Enter** key. Data entry fields require that a value be entered into the field within a given, applicable range. In the example below, RCU Address field is highlighted:



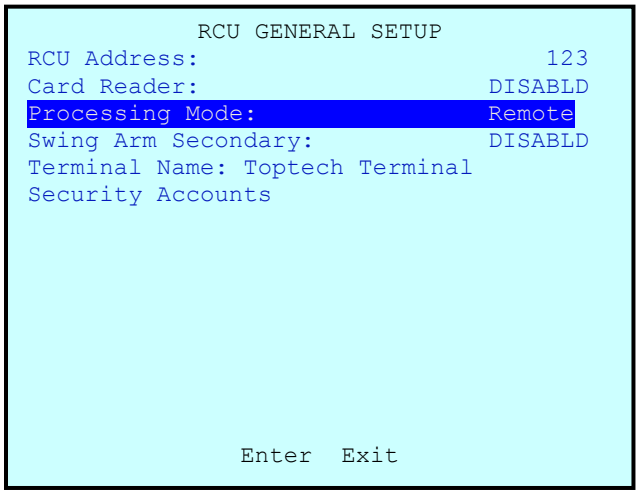
Press **Enter** to choose the field. A blinking cursor indicates that data can be entered.



Type in the new value (e.g. 123) and press **Enter**. The new value displays on the screen.

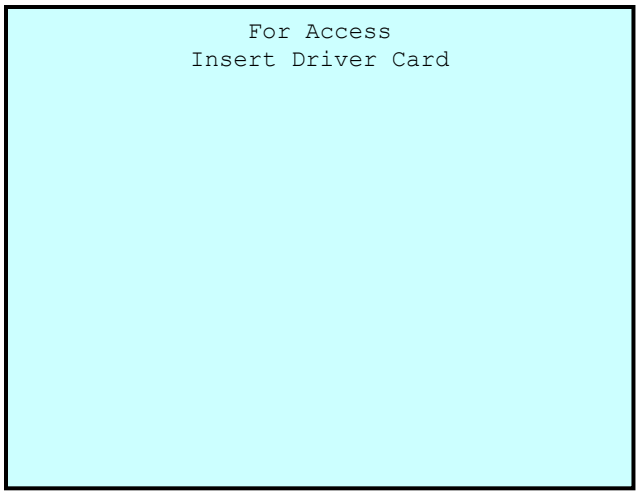


Using this same screen as an example, the Processing Mode line is selected and **Enter** is pressed; use the **Next** or **Prev** keys to toggle between the values ENABLED and DISABLED, as shown below. You must then press **Enter** to accept the desired choice.



6.5 MultiLoad II/ RCU II Preliminary Configuration

1) Power-on the MultiLoad II/ RCU II.
2) When the MultiLoad II is first powered-on, the card–in screen appears, indicating Operating Mode. An RCU II may initially display “System Unavailable” because it is unconnected to a host system.



3) Go to program mode by entering **00000** on the keypad, then press **Next**.

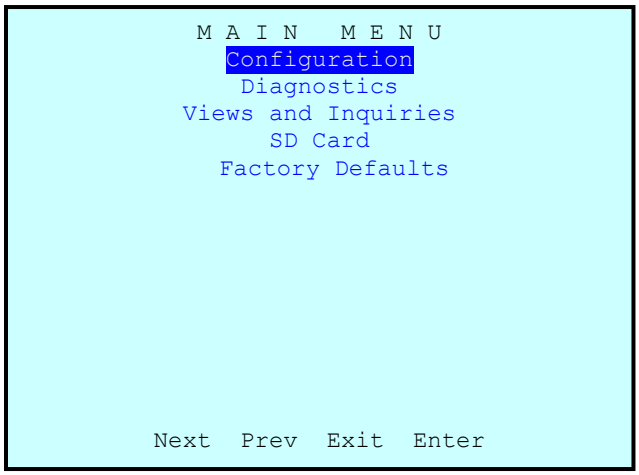
A MultiLoad II must have the Program switch set to allow access to Program Mode (See section 6.1).

00000 is the factory default access code. See the "MultiLoad II User Guide," RCU General Setup section for changing or adding new access codes.

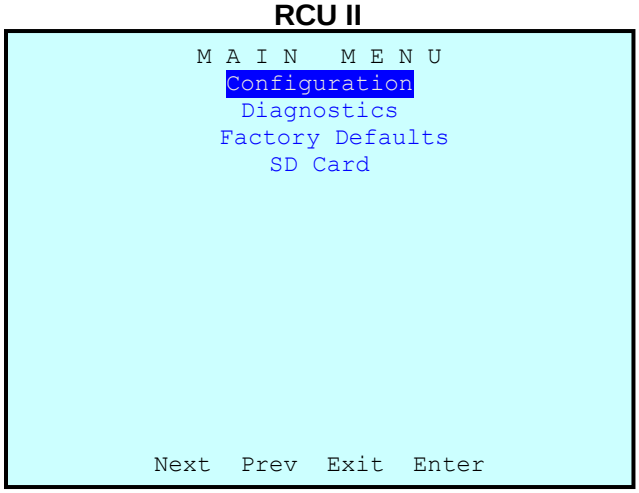
Note that unlike MultiLoad II, Program switches or CPU DIP switches never deny access to RCU II Program Mode.

4) The program mode main menu displays the following:

MultiLoad II



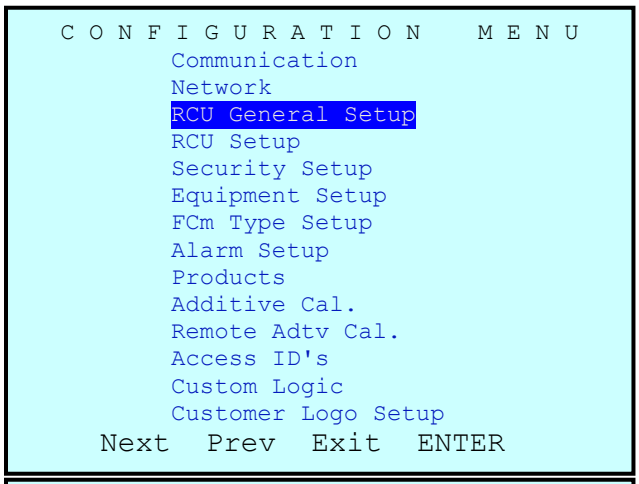
RCU II

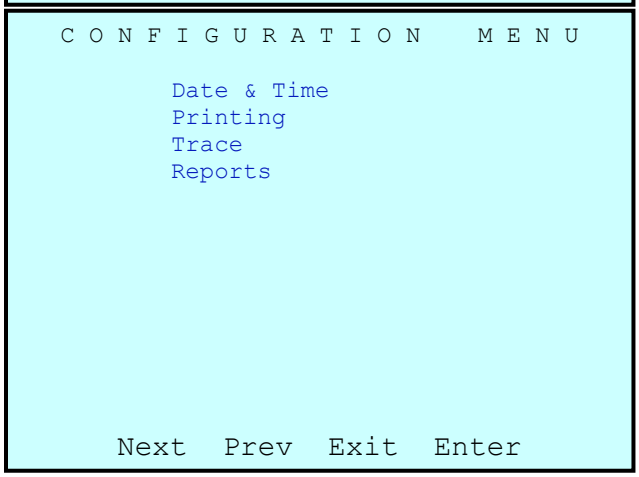


5) Press **Enter** to access the Configuration menu.

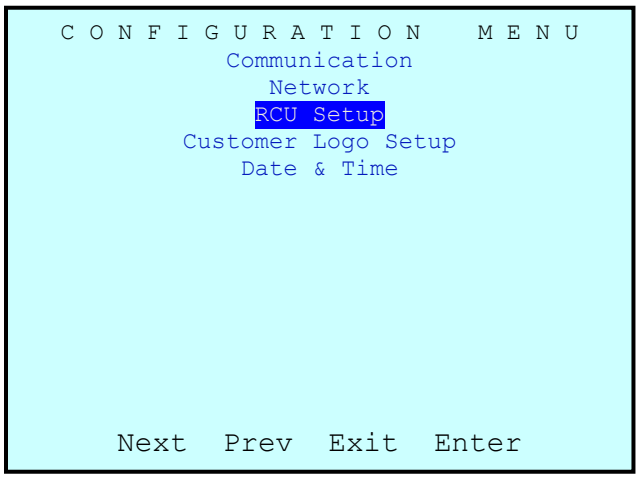
6) Press **Enter** to access RCU General Setup/ RCU Setup:

MultiLoad II (2 pages)



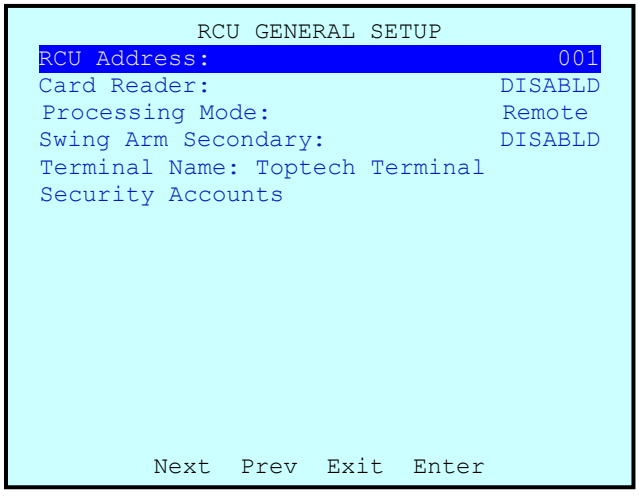


RCU II

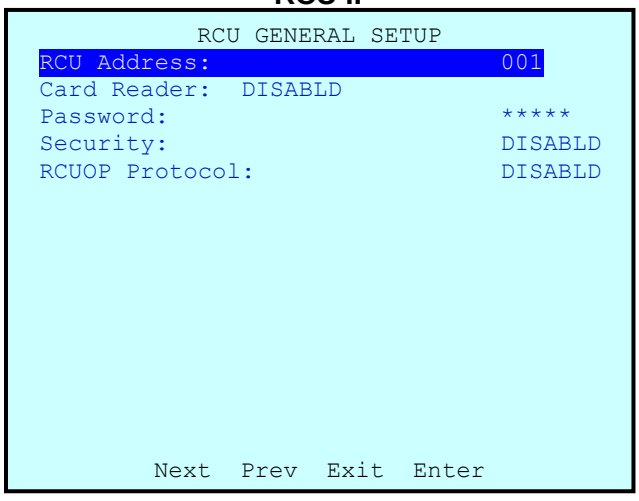


7) Press **Enter** and key in **RCU Address** (001, or as desired) for the MultiLoad II/ RCU II:

MultiLoad II



RCU II



8) Press **Enter** to save, then press **Exit** to return to the Configuration Menu.
9) Press **Exit** to return to the Main Menu.
10) When finished with configuration or diagnostics, please reset MultiLoad external switches (see 6.1).

6.6 Verifying Communications between MultiLoad II/ RCU II and I/O Board

1) Enter program mode by pressing **00000** on the keypad, then press **Next** key.
2) Select diagnostics from main menu:

MultiLoad II

```
    D I A G N O S T I C S    M E N U
Card Reader          Preset
COM Loopback         Meters
Serial Ports         Components
PTB Serial -Test     Additives
Network Test         Sampler
Keypad               Custom Logic
Display              Modbus Device
Unicode              Thread Info
FCM Com              SD Card
PCM Com
FCM Health
PCM Health
RCU
Bay
         Next  Prev  Exit  Enter
```

RCU II

```
D I A G N O S T I C S    M E N U
          Card Reader
          COM Loopback
          Serial Ports
          Network Test
             Keypad
             Display
             Unicode
               RCU

          Next  Prev  Exit  Enter
```

3) For MultiLoad II, select FCM COM. For RCU II, select RCU:

MultiLoad II

```
000        FCM COM DIAGNOSTICS
                  00-Ok

                    Exit
```

RCU II

```
            RCU I/O DIAGNOSTICS
I/O Board Com: Ok     F/W Rev:  033
Timeouts: 000000003  Com Lost: 000000001
[1]AC Output 0  - OFF  DC Input 4 - OFF
[2]AC Output 1  - OFF  DC Input 5 - OFF
[3]AC Output 2  - OFF  DC Input 6 - OFF
[4]AC Output 3  - OFF  DC Input 7 - OFF
[5]AC Output 8  - OFF  DC Input 9 - OFF
[6]DC Output 10 - OFF  Counter 4 - 00000
[7]DC Output 11 - OFF  Counter 5 - 00000
[8]DC Output 12 - OFF  Program Key- OFF
                         W&M Key    - OFF
                     Battery @ 36C 3.24V
                     Battery        100%

                  Exit  Clear
```

4) If screen displays “00-OK” (or “I/O Board Com: OK” for the RCU II), the I/O board is communicating with the MultiLoad II or RCU II.
5) If the I/O board is not communicating the message “00-ERR” appears (or “I/O Board Com: ERR” for the RCU II).
6) If 00-ERR (or “I/O Board Com: ERR”) appears, verify the communication parameters for Com0 within the Communication Setup Menu. This menu is located under the Configuration Menu. The Com0 communication settings required for the I/O board are .57.6 (K Baud), None (Parity), 8 Data (bits), 1 Stop (bit), Single, and I/O Board (type of serial device). This is correctly set in the factory when an RCU II is assembled, but it is possible for the settings to be updated by the installer.

6.7 Using I/O Diagnostics

MultiLoad II: Consult the MultiLoad II User Manual for diagnostics functions.

RCU II: Each output is listed on the “RCU I/O Diagnostics” screen, adjacent to a [number]. Press the number on the keypad corresponding to the output under test. If the connection has been made properly, the field device will actuate.

NOTE: If numbers do not appear next to the outputs, enter **Configurations → RCU Setup** and change the password from the default “**00000**”.

Inputs: Each input is listed on the screen adjacent to its status. Each input will be in either the ON or OFF state. Activate each input from the field. If the circuit is connected properly, the state change can be observed.

For the counter inputs, the totals will accrue as long as they are receiving pulses (**MultiLoad II/ RCU II).**

Chapter 7

Chapter 7 Service and Repair

Do not service MultiLoad II/ RCU II without disconnecting the supply circuit. Keep the enclosure tightly closed while circuits are live.

Using a magnetic screwdriver is very helpful in retaining the screws during removal and installation.

7.1 Overview and Subassemblies

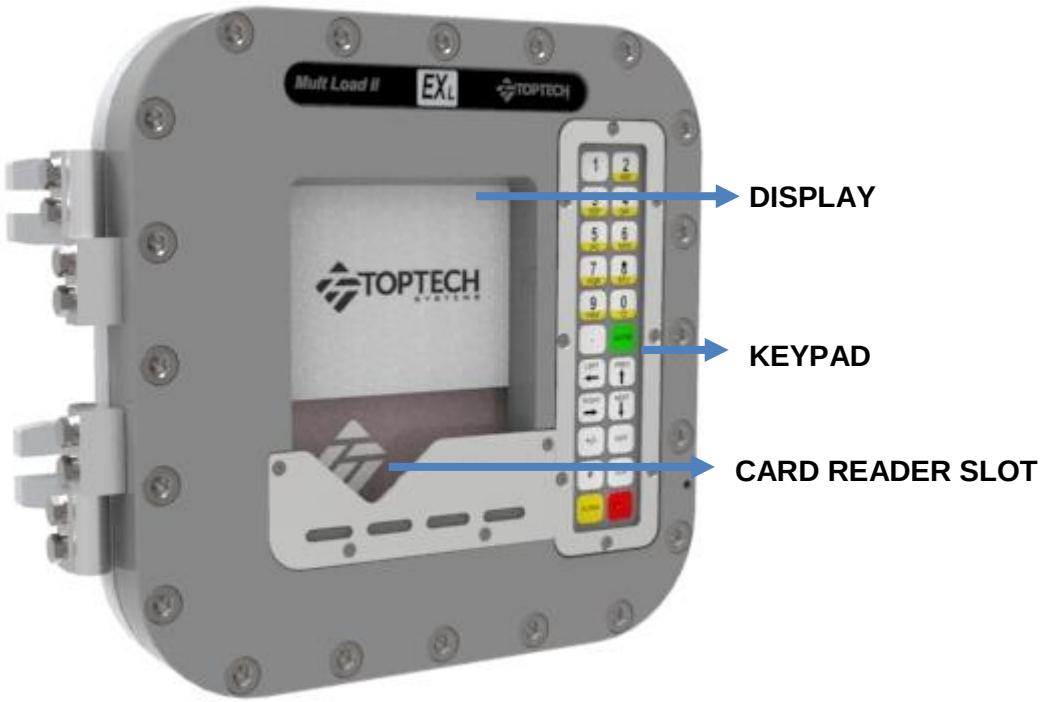


Figure 7.1 MultiLoad II (ML II) / Remote Control Unit II (RCU II) Explosion Proof Lite Unit

DISPLAY

The MultiLoad II/ RCU II EXL has been constructed with replaceable modules or sub-assemblies that are available from Toptech. These include:

- CPU Subassembly (CPU Chassis, CPU Board, Power Supply/ COM Board, I/O Board) **1**
- Display Subassembly (Active Matrix Display and Display Board) **2**
- Keypad **3**
- Keypad Barrier Circuit **4**
- Prox Reader **5**
- W&MS Subassembly **6**

The following sections describe how to remove and replace each subassembly and, when applicable, how to further disassemble the subassembly.

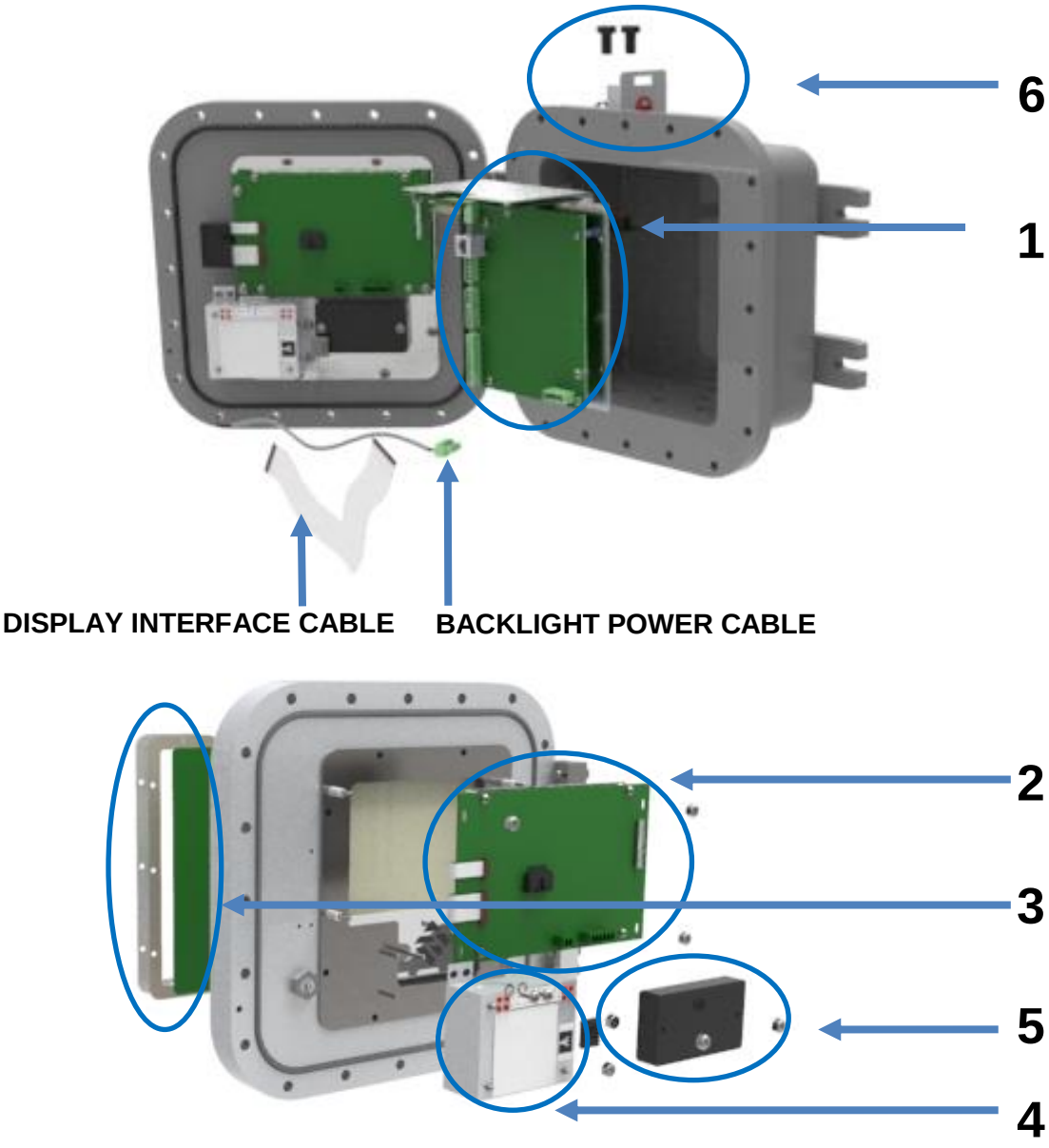


Figure 7.2 ML II/ RCU II EXL Unit Assembly

7.2 CPU Subassembly Removal and Replacement

The CPU subassembly exists out of the CPU chassis with the power supply/communications board and the CPU mounted. Optionally, an I/O board can be added to this subassembly. The CPU subassembly is comprised of different Toptech Parts.

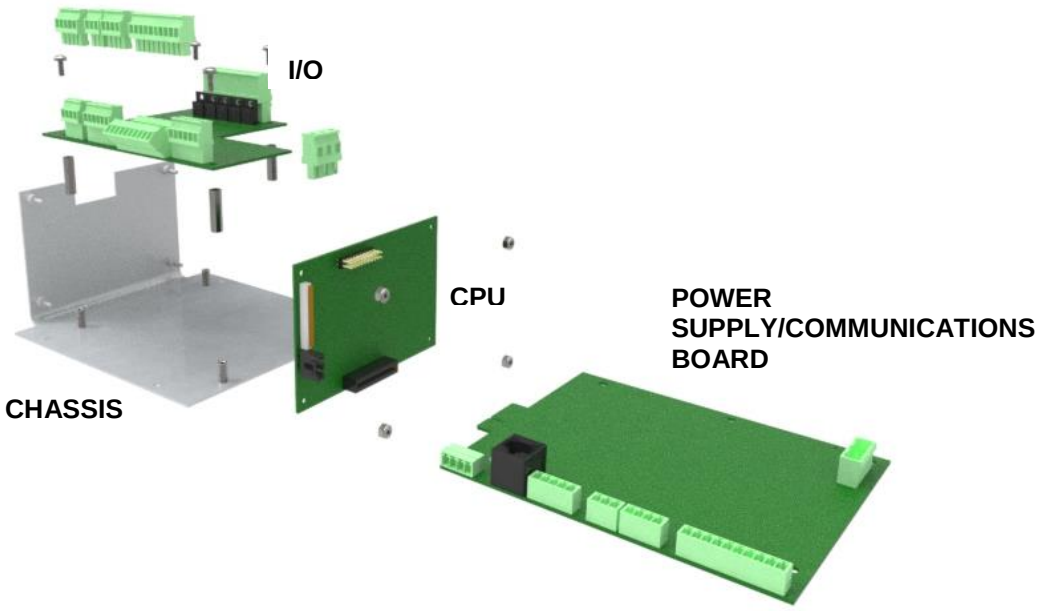


Figure 7.3 CPU Board, Power Supply / Comm Board, I/O Board with Chassis

Part Numbers:

Power Supply & Communication Board:

AC –Power Supply Board: 4728

DC – Power Supply Board: 4729

CPU Board: 4727

I/O Boards:

Digital/Analog I/O Board: 4718

2 Meter I/O Board: 4723

Removal:

1. Disconnect all field wiring from the I/O board.
2. Disconnect all Serial Communications from the Power Supply/COM board.
3. Disconnect Main Power from the Power Supply/COM board.
4. Disconnect the flat display cable (after releasing the cam lock) and display power cable.
5. Disconnect the W&M Access/Program Mode switch cable from the CPU board.
6. Remove the four chassis mounting screws (not the mounting screws for the I/O board or Power Supply / COM board).
7. Carefully remove the CPU chassis from inside the base by removing the CPU board side of the chassis first.

Installation:

1. Carefully insert the CPU chassis back into the enclosure.
2. Install the chassis mounding screws.
3. Connect the W&M Access/Program Mode switch cable to the CPU board.
4. Reconnect the display power cable and the flat display cable (remember to secure the cam lock).
5. Connect the Main Power to the Power Supply/COM board.
6. Connect all Serial Communications to the Power Supply/COM board.
7. Connect all field wiring to the I/O board.

7.3 Display Subassembly Removal and Replacement

Part Number: **EXL Display Subassembly: 1667**

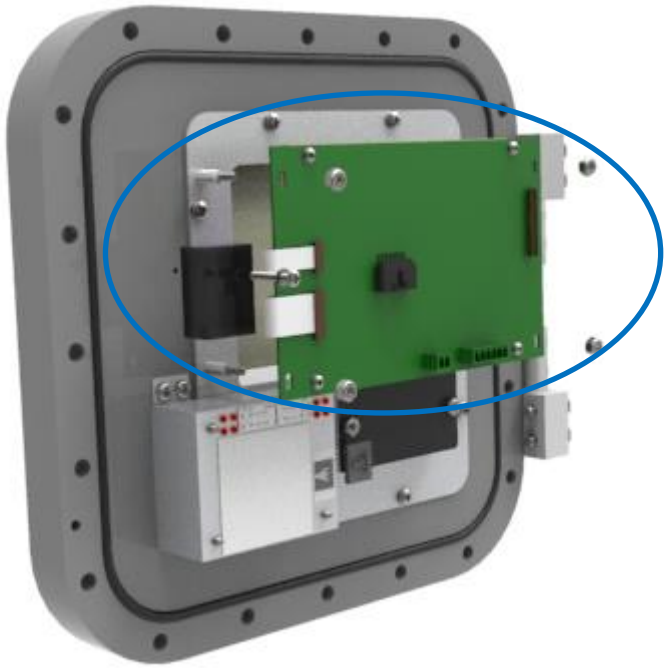
Backlight Power Cable: 1663

Removal:

1. Disconnect the flat display cable (after releasing the cam lock –see 7.3.1), display power cable and the keypad cable.
2. While supporting the display subassembly, remove the four mounting screws.
3. **Do not attempt to disassemble the display subassembly.** Return entire subassembly to Toptech for repair after receiving an RMA number.

Installation:

1. While supporting the display subassembly, install the four mounting screws.
2. Connect the keypad cable, display power cable and the flat display cable.
3. Verify routing and clearance of the cable



DISPLAY ASSEMBLY

Figure 7.4 ML II/ RCU II EXL Unit Cover Display Assembly

7.3.1 Flat Display Cable Connector: Remove and Connect

Part Number: Display Interface Cable: 1250

Removal:

1. To remove the display cable, rotate the cam to the open (up) position (see Figure 7.5).
2. Gently pull the cable straight out free of the connector.

Installation:

1. To install the display cable, make sure the cam is in the open (up) position.
2. Gently insert the cable with the dark insulated side towards the cam (see Figure 7.6). When inserting the cable, ensure that it is not tilted to one side and that the bottom of the cable is completely seated in the connector.
3. Rotate the cam to the closed (down) position to lock in place (see Figure 7.7).

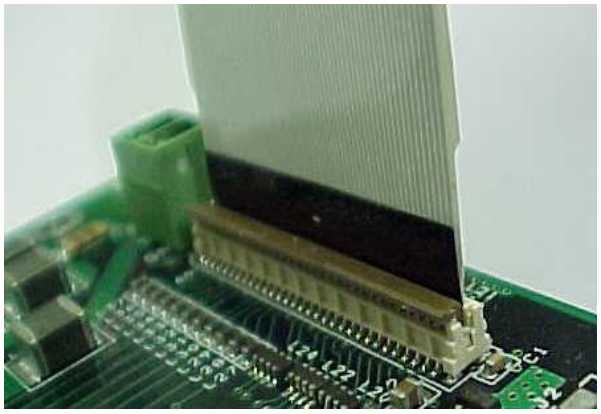


Figure 7.5 Cam Lock Up (Open Position)

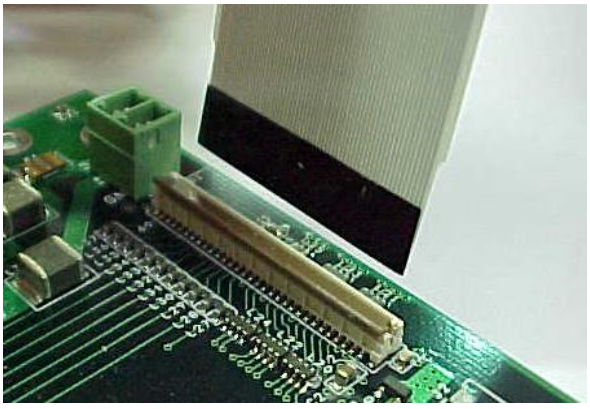


Figure 7.7 Display Cable Insertion

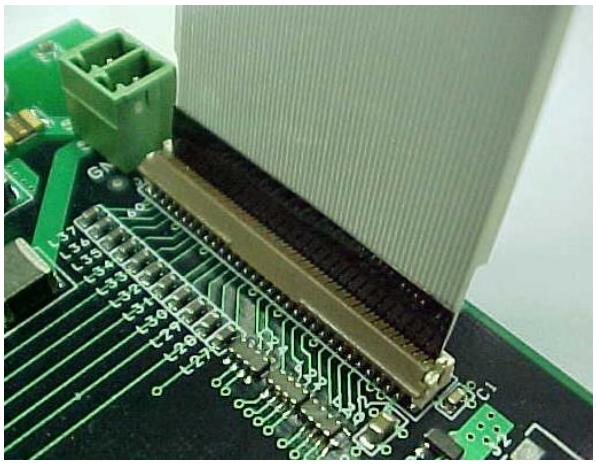


Figure 7.6 Cam Lock Down (Closed Position)

7.4 Keypad Removal and Replacement

Part Number: EXL-Keypad: 1638

Removal:

1. Using a Torx T10 security screwdriver bit (available from McMaster Carr); remove all security screws holding on the Keypad bezel.
2. Remove the bezel.
3. Using a small flat screwdriver, carefully pry up the sealing gasket and keypad. They will both be removed together. The gasket cannot be reused.
4. Disconnect the keypad cable from the back of the keypad by depressing the connector latch to remove the cable.

Installation:

1. Connect the keypad cable to the back of the keypad.
2. Slide the keypad wires to the side of the connector install the keypad. The wires must be to the side of the connector for the keypad to sit flush all the way around the edge. Place a weighted object on top of the keypad to hold it down and in place for installing the new gasket.
3. Carefully remove the protective paper covering the adhesive gasket on the front keypad surface. NOTE: The gasket is a moisture seal it must be used.
4. Install the keypad bezel.
5. Using a security screwdriver bit, install all the bezel holding security screws.

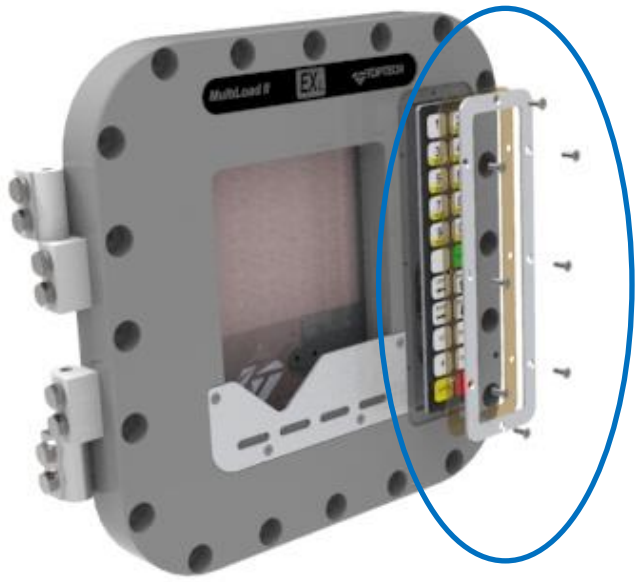


Figure 7.8 ML II/ RCU II EXL Unit Cover Keypad Assembly

7.5 Keypad Barrier Removal and Replacement

Part Number: EXL-Keypad Barrier: **Version 1.1 - (obsolete)**

Version 2.0 – (current): 2710

The current keypad barrier (version 2.0) can be recognised by LED indicators.

Barrier verson 1.1 is interchangeable with the current 2.0 version.

Figure 7.9 **Keypad Barrier Version 1.1**

Figure 7.10 Keyapd Barrier Version 2.0 (LED indicators)

7.5.1 Keypad Barrier Version 2.0 (LED indicators)

Removal:

1. Remove the outside connector plug from the barrier side header.
2. Remove the four screws holding barrier circuit box.
3. Remove the inside connector plug from the barrier circuit board header.

Installation:

4. Reinstall the inside connector plug to the barrier circuit board header.
5. Reinstall the barrier circuit box with the four holding screws.
6. Reinstall the outside connector plug to the barrier side header.

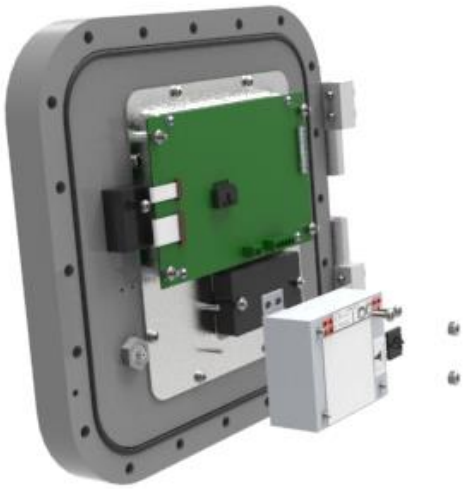


Figure 7.11 ML II/ RCU II EXL Unit Cover with Barrier Version 2.0 (current)

7.5.2 Keypad Barrier Version 1.1 (no LED indicators)

This barrier can be changed out by a version 2.0.

Removal:

1. Disconnect the keypad cable from the display subassembly.
2. Remove the four screws holding barrier circuit box.
3. One by one, move over the keypad wires to a new barrier circuit.

Installation:

1. Reinstall the barrier circuit box with the four holding screws.
2. Connect the keypad cable to the display subassembly.

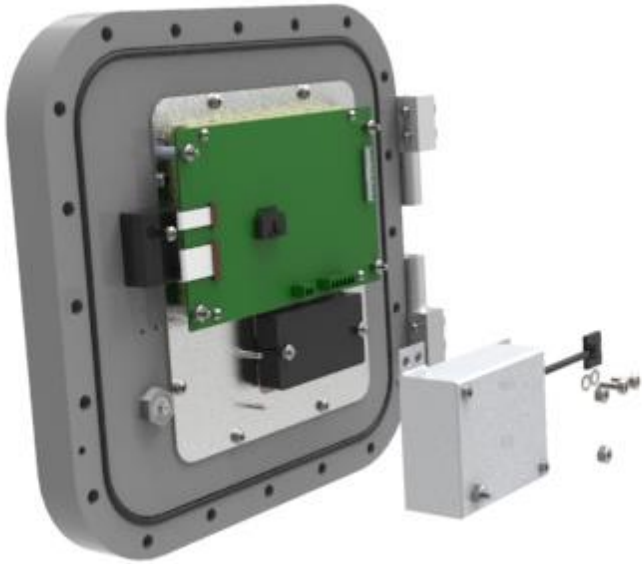


Figure 7.12 ML II/ RCU II EXL Unit Cover with Barrier Version 1.1 (Obsolete)

7.6 Card Reader Removal and Replacement

Part Number: EXL Prox Card Reader 1669

Removal:

1. Disconnect the prox reader cable from the display subassembly.
2. Remove the two nuts holding prox reader.
3. Remove the prox reader.

Installation:

1. Reinstall the prox reader with the two nuts.
2. Connect the prox reader cable to the display subassembly.

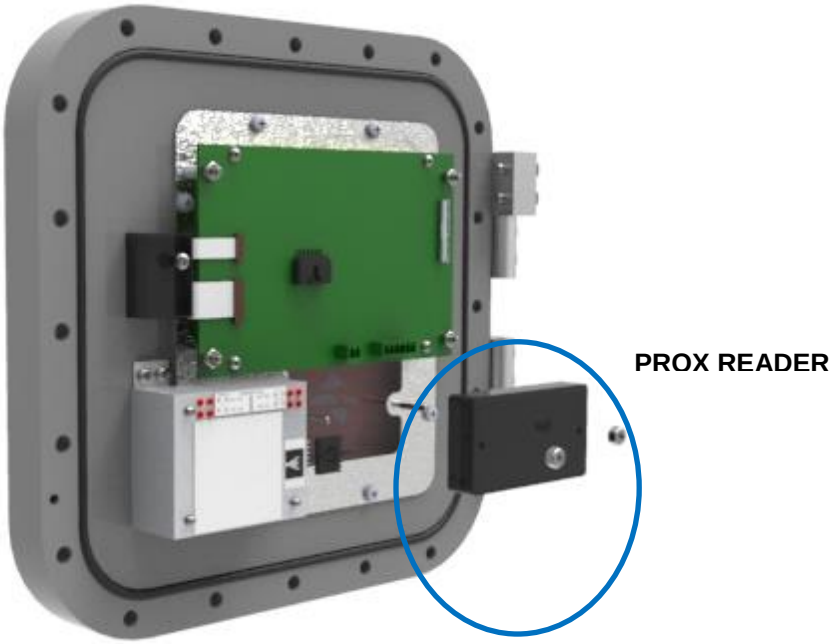


Figure 7.13 ML II/ RCU II EXL Cover Assembly Prox Bracket Mount

7.7 W&M Switch Assembly Removal and Replacement

Part Number: **W&M Assembly Board:** **1900**

W&M Bolt: **1901**

This assembly is only found for MultiLoad II EXL devices.

Removal:

1. Unplug the cable from the CPU board. Carefully depress the locking mechanism on the connector and gently pull.
2. Remove the two screws securing the switch board assembly.
3. Remove the board.

Installation:

1. Install the new switch assembly using the same screws. Install with the cut corners facing outward. DO NOT over-tighten and simply secure gently. Over-tightening will crack the ferrite rings, damaging the switch.
2. Reinstall the connector.
3. Installation complete.

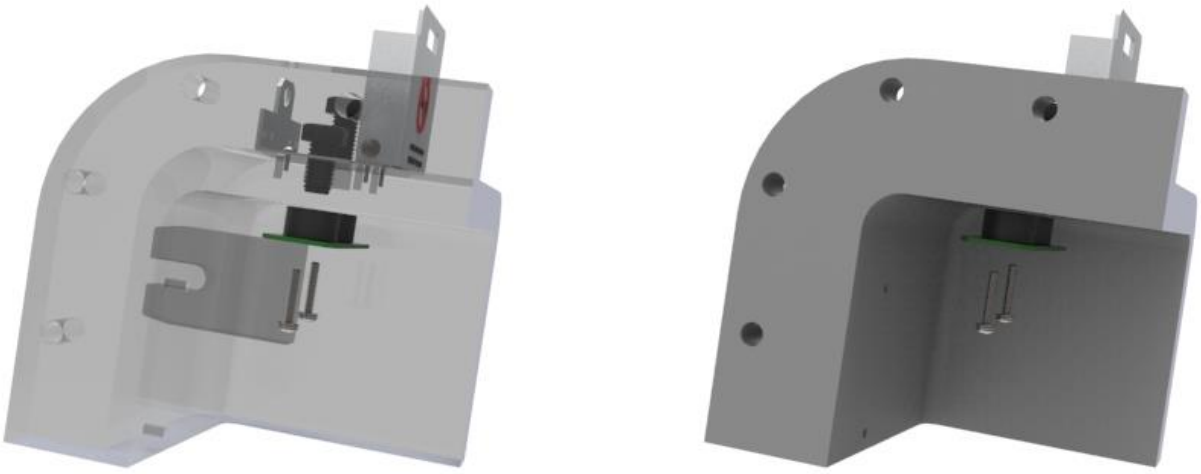


Figure 7.14 ML II/ RCU II EXL W&M Assembly

7.8 Overview Parts List and Part Numbers

The Toptech replacement part numbers are shown in the table below:

Part	Part Number
EXL Display Assembly	1667
EXL Prox Card Reader	1669
EXL Keypad	1638
EXL Keypad Barrier (1.1)	obsolete
EXL Keypad Barrier (2.0)	2710
Magnetic Switch Assembly	1900
Magnetic Bolt Assembly	1901
Display Interface Cable	1250
EXL backlight power cable	1663

Part	Part Number
AC Power Supply Board :	
Revision 1.0, 1.1	obsolete
Revision 1.2	4728
DC Power Supply Board :	
Revision 1.0, 1.1	obsolete
Revision 1.2	4729
I/O Board :	
Digital/ Analog I/O, revision 1.3	4718
2 Meter I/O Board, revision 1.2	4723
CPU Board :	
Revision 1.0, 2.0	obsolete
Revision 2.1	4727

Chapter 8

Chapter 8 Hardware Revision History & Compatibility

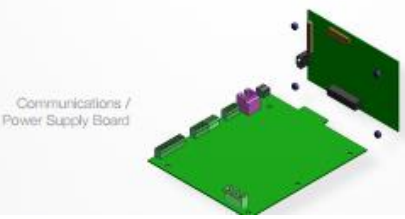
Active Parts

Part	Part#	Rev#	Description	In-Production
MultiLoad II CPU-Board	4723	1.0	Initial board	⊗
		2.0	Addition of new CPU, SD card slot; Ethernet circuitry now supports auto-crossover function	⊗
		2.1	Addition of battery voltage monitoring, added ambient temperature monitoring	✓
MultiLoad II AC Power Supply and Communications Board	4728	1.0	Initial board	⊗
		1.1	Ethernet circuitry now supports auto-crossover function (used by CPU 2.0)	⊗
		1.2	Added 2-wire 485 to COM2, added power on reset logic to received handshake signals of COM2, pluggable 5V inter-board header	✓
MultiLoad II DC Power Supply and Communications Board	4729	1.0	Initial board	⊗
		1.1	Ethernet circuitry now supports auto-crossover function (used by CPU 2.0)	⊗
		1.2	Added 2-wire 485 to COM2, added power on reset logic to received handshake signals of COM2, pluggable 5V inter-board header	✓

Compatibility Chart

	Power Supply / Communications Board		
CPU Board	1.0	1.1	1.2
1.0	✓	⊗	⊗
2.0	⊗	✓	✓
2.1	⊗	✓	✓

	Firmware Version	
CPU Board	3.xx.yy	4.xx.yy
1.x	✓	⊗
2.x	⊗	✓



Chapter 9

Chapter 9 Revision History

9.1 Hardware Revision

Date	Description
07/20/2008	Initial product release with ATEX certification.
12/19/2008	C/US UL Listing issued.
08/25/2009	Added display heater option.
08/25/2009	Alternate cast enclosure with alternate cement.
01/09/2009	Released magnetic switches for configuration & weights and measures.
03/25/2010	Changed regulatory agency from UL to CSA.
02/08/2011	Released new CPU board (CPU rev 2.0), and Ethernet update on power supply/ com boards (AC-INT rev 1.1, DC-INT rev 1.1)
02/08/2011	Released 2 Meter I/O board option (IO_2M rev 1.0).
03/08/2011	Changed regulatory agency from CSA to Intertek.
04/08/2011	IECEx certificate issued.
01/17/2012	Replaced relay assemblies on I/O board with discrete triacs (IO_DA rev 1.2, IO_2M rev 1.1).
06/07/2013	Added 2-wire 485 to COM2, thru hole ethernet socket, pluggable 5V inter-board header, new DC supply not transformer isolated (AC-INT rev 1.2; DC-INT rev 1.2)
10/01/2014	Improved RTD filtering (IO_DA rev 1.3, IO_2M rev 1.2)
09/24/2015	Released SCS_IO board (rev 1.0)
07/02/2018	Released barrier version 2.0

9.2 Manual Revision

Revision	Date	Description
1.0 (ML)	07/31/2007	Release.
1.1 (ML)	02/21/2008	Expanded I/O section to show FCM I and FCM II wiring connections; described FCM comm. wiring in chapter 4; reorganized serial comm description by function not port.
1.2 (ML)	04/18/2008	Removed FCM diagrams from chapter 4 and placed them in separate FCM manual.
1.3 (ML)	12/19/2008	Added instructions required by update from UL508 to UL61010-1 that customer is required to use a Class 2 power source when using the DC power supply; described wiring partitions; described three types of PGM W&M switches: shaft and magnetic bolts; first release of magnetic switch construction; added table of torque requirements for all terminal block plugs used to section 2.3 as required by UL.
1.0 (RCU)	02/26/2009	Release of RCU II EXL Installation Guide.
1.4 (ML)	10/02/2009	Added operating characteristics summary; changed format to mirror the new MultiLoad II format in the I/O section.
1.5	02/18/2011	Added wiring diagrams for 2 Meter I/O board; added wiring diagrams for Lectro Count; added Intertek requirements including Canadian required French bilingual warnings; combined RCU II EXL and ML II EXL into common manual; added Canadian IS ground wiring instructions.
1.5	03/11/2011	Editorial: pp. 3, 28, 70, 72, 73; noted SD Card menu in Chapter 5.
1.5	10/29/2012	Corrected additive input mistake, updated mechanical drawings showing slotted card holder
	10/31/2012	Removed revision number—control by date.
	10/31/2012	Added Hardware revision table.
	10/31/2012	Clarified 4-20mA input wiring. Corrected COM2 label errors in diagram.
	10/31/2012	Updated label, updated warnings, updated European DOC.
	10/18/2013	Removed the wiring partition (figures 2.5 – 2.7)
	10/18/2013	Updated EN standards to latest editions.
	04/19/2016	Revised Declaration of Conformity for 4/20/2016 directive revision.

	11/10/2017	Updated 60079-1 to the latest edition (2014). Removed expired old ATEX DOC.
	12/27/2018	Manual update, formatting changes, restructuring, Updated Chapter 5 I/O wiring figures to support multilingual support, improved mechanical drawings, updated Declaration of Conformity, and included I/O heat dissipation, chapter 7 updated and completed.
	05/13/2019	Updated version date, spelling, grammar, Declaration of Conformity, and basic formatting changes.
	05/13/2019	Updated 4-20 mA input wiring (see 5.4.4.2)

Toptech Systems

North America office:

Toptech Systems Inc

1124 Florida Central Parkway
Longwood, FL 32750, USA
Phone: +1 (407) 332-1774

Europe office:

Toptech Systems NV
Nieuwe Weg 1
2070 Zwijndrecht (Antwerp), Belgium
Phone: +32 (0)3 250 60 60