# IntelliFlow™ RF2
# Automatic and Manual Systems


For other languages of this service manual and additional product information, please scan the QR code above.

# CONTENTS

# CONTENTS (cont.)

# SAFETY

## SAFETY PRECAUTIONS

Before operating, maintaining or servicing any Carlisle system, read and understand all of the technical and safety literature for your Ransburg products. This manual contains information that is important for you to know and understand. This information relates to **USER SAFETY and PREVENTING EQUIPMENT PROBLEMS.**

To help you recognize this information, we use the following symbols. Please pay particular attention to these sections.

**⚠ WARNING**

A WARNING! states information to alert you to a situation that might cause serious injury if instructions are not followed.

**⚠ CAUTION**

A CAUTION! states information that tells how to prevent damage to equipment or how to avoid a situation that might cause minor injury.

**NOTE**

A NOTE is information which is relevant to the procedure in progress.

This manual lists standard specifications and service procedures. Minor differences can occur between this literature and your equipment. Differences in local or municipal codes, manufacturer or plant requirements, material delivery requirements, and more can make variations unpreventable. Compare this manual to your system installation drawings and other applicable Ransburg equipment manuals to find these differences.

Careful study and continued use of this manual will provide a better understanding of the equipment functions and procedures. This will result in improved operation, efficiency, and longer, trouble-free service with faster and easier troubleshooting. If you need the necessary manuals and safety literature for your specific Ransburg system, contact your local Ransburg representative or Ransburg directly.

**⚠ WARNING**

The user **MUST** read and be familiar with the Safety Section in this manual and the Ransburg safety literature therein identified.

This equipment is intended to be used by trained personnel **ONLY**.

This manual **MUST** be read and thoroughly understood by **ALL** personnel who operate, clean or maintain this equipment! Special care should be taken to ensure that the **WARNINGS** and safety requirements for operating and servicing the equipment are followed. The user should be aware of and adhere to **ALL** local building and fire codes and ordinances as well as **NFPA-33 AND EN 50176 SAFETY STANDARDS, LATEST EDITION**, or applicable country safety standards, prior to installing, operating, and/or servicing this equipment.

**⚠ WARNING**

The hazards shown on the following pages may occur during the normal use of this equipment.

| AREA<br>Tells where hazards may occur. | HAZARD<br>Tells what the hazard is. | SAFEGUARDS<br>Tells how to avoid the hazard. |
|---|---|---|
| **Spray Area**<br>  | **Fire Hazard**<br><br>Improper or inadequate operation and maintenance procedures will cause a fire hazard.<br><br>Protection against inadvertent arcing that is capable of causing fire or explosion is lost if any safety interlocks are disabled during operation.<br><br>Frequent Power Supply or Controller shutdown indicates a problem in the system requiring correction. | Fire extinguishing equipment must be present in the spray area and tested periodically.<br><br>Spray areas must be kept clean to prevent the accumulation of combustible residues.<br><br>Smoking must never be allowed in the spray area.<br><br>The high voltage supplied to the atomizer must be turned off prior to cleaning, flushing or maintenance.<br><br>Spray booth ventilation must be kept at the rates required by NFPA-33, OSHA, country, and local codes. In addition, ventilation must be maintained during cleaning operations using flammable or combustible solvents.<br><br>Electrostatic arcing must be prevented. Safe sparking distance must be maintained between the parts being coated and the applicator. A distance of 1 inch for every 10KV of output voltage is required at all times.<br><br>Test only in areas free of combustible material. Testing may require high voltage to be on, but only as instructed.<br><br>Non-factory replacement parts or unauthorized equipment modifications may cause fire or injury. If used, the key switch bypass is intended for use only during setup operations. Production should never be done with safety interlocks disabled.<br><br>The paint process and equipment should be set up and operated in accordance with NFPA-33, NEC, OSHA, local, country, and European Health and Safety Norms. |

| AREA<br>Tells where hazards may occur. | HAZARD<br>Tells what the hazard is. | SAFEGUARDS<br>Tells how to avoid the hazard. |
|---|---|---|
| **Spray Area**<br>  | **Explosion Hazard**<br><br>Improper or inadequate operation and maintenance procedures will cause a fire hazard.<br><br>Protection against inadvertent arcing that is capable of causing fire or explosion is lost if any safety interlocks are disabled during operation.<br><br>Frequent Power Supply or Controller shutdown indicates a problem in the system requiring correction. | Electrostatic arcing must be prevented. Safe sparking distance must be maintained between the parts being coated and the applicator. A distance of 1 inch for every 10KV of output voltage is required at all times.<br><br>Unless specifically approved for use in hazardous locations, all electrical equipment must be located **outside** Class I or II, Division 1 or 2 hazardous areas, in accordance with NFPA-33.<br><br>Test only in areas free of flammable or combustible materials.<br><br>The current overload sensitivity (if equipped) MUST be set as described in the corresponding section of the equipment manual. Protection against inadvertent arcing that is capable of causing fire or explosion is lost if the current overload sensitivity is not properly set. Frequent power supply shutdown indicates a problem in the system which requires correction.<br><br>Always turn the control panel power off prior to flushing, cleaning, or working on spray system equipment.<br><br>Before turning high voltage on, make sure no objects are within the safe sparking distance.<br><br>Make sure that the control panel is interlocked with the ventilation system and conveyor in accordance with NFPA-33, EN 50176.<br><br>Have fire extinguishing equipment readily available and tested periodically. |
| **General Use and Maintenance**<br>  | Improper operation or maintenance may create a hazard.<br><br>Personnel must be properly trained in the use of this equipment. | Personnel must be given training in accordance with the requirements of NFPA-33, EN 60079-0.<br><br>Instructions and safety precautions must be read and understood prior to using this equipment.<br><br>Comply with appropriate local, state, and national codes governing ventilation, fire protection, operation maintenance, and housekeeping. Reference OSHA, NFPA-33, EN Norms and your insurance company requirements. |

| AREA<br>Tells where hazards may occur. | HAZARD<br>Tells what the hazard is. | SAFEGUARDS<br>Tells how to avoid the hazard. |
|---|---|---|
| **Spray Area High Voltage Equipment**<br>  | **Electrical Discharge**<br><br>There is a high voltage device that can induce an electrical charge on ungrounded objects which is capable of igniting coating materials.<br><br>Inadequate grounding will cause a spark hazard. A spark can ignite many coating materials and cause a fire or explosion. | Parts being sprayed and operators in the spray area must be properly grounded.<br><br>Parts being sprayed must be supported on conveyors or hangers that are properly grounded. The resistance between the part and earth ground must not exceed 1 meg ohm. (Refer to NFPA-33.)<br><br>Operators must be grounded. Rubber soled insulating shoes should not be worn. Grounding straps on wrists or legs may be used to assure adequate ground contact.<br><br>Operators must not be wearing or carrying any ungrounded metal objects.<br><br>When using an electrostatic handgun, operators must assure contact with the handle of the applicator via conductive gloves or gloves with the palm section cut out.<br><br>NOTE: REFER TO NFPA-33 OR SPECIFIC COUNTRY SAFETY CODES REGARDING PROPER OPERATOR GROUNDING.<br><br>All electrically conductive objects in the spray area, with the exception of those objects required by the process to be at high voltage, must be grounded. Grounded conductive flooring must be provided in the spray area.<br><br>Always turn off the power supply prior to flushing, cleaning, or working on spray system equipment.<br><br>Unless specifically approved for use in hazardous locations, all electrical equipment must be located **outside** Class I or II, Division 1 or 2 hazardous areas, in accordance with NFPA-33.<br><br>Avoid installing an applicator into a fluid system where the solvent supply is ungrounded.<br><br>Do not touch the applicator electrode while it is energized. |

| AREA<br>Tells where hazards may occur. | HAZARD<br>Tells what the hazard is. | SAFEGUARDS<br>Tells how to avoid the hazard. |
|---|---|---|
| **Electrical Equipment**<br>  | **Electrical Discharge**<br>High voltage equipment is utilized in the process. Arcing in the vicinity of flammable or combustible materials may occur. Personnel are exposed to high voltage during operation and maintenance.<br><br>Protection against inadvertent arcing that may cause a fire or explosion is lost if safety circuits are disabled during operation.<br><br>Frequent power supply shutdown indicates a problem in the system which requires correction.<br><br>An electrical arc can ignite coating materials and cause a fire or explosion. | Unless specifically approved for use in hazardous locations, the power supply, control cabinet, and all other electrical equipment must be located outside Class I or II, Division 1 and 2 hazardous areas in accordance with NFPA-33 and EN 50176.<br><br>Turn the power supply OFF before working on the equipment.<br><br>Test only in areas free of flammable or combustible material.<br><br>Testing may require high voltage to be on, but only as instructed.<br><br>Production should never be done with the safety circuits disabled.<br><br>Before turning the high voltage on, make sure no objects are within the sparking distance. |
| **Toxic Substances**<br>  | **Chemical Hazard**<br><br>Certain materials may be harmful if inhaled, or if there is contact with the skin. | Follow the requirements of the Safety Data Sheet supplied by coating material manufacturer.<br><br>Adequate exhaust must be provided to keep the air free of accumulations of toxic materials.<br><br>Use a mask or respirator whenever there is a chance of inhaling sprayed materials. The mask must be compatible with the material being sprayed and its concentration. Equipment must be as prescribed by an industrial hygienist or safety expert, and be NIOSH approved. |
| **Spray Area**<br>  | **Explosion Hazard — Incompatible Materials**<br><br>Halogenated hydrocarbon solvents for example: methylene chloride and 1,1,1, - Trichloroethane are not chemically compatible with the aluminum that might be used in many system components.<br><br>The chemical reaction caused by these solvents reacting with aluminum can become violent and lead to an equipment explosion. | Spray applicators require that aluminum inlet fittings be replaced with stainless steel.<br><br>Aluminum is widely used in other spray application equipment - such as material pumps, regulators, triggering valves, etc. Halogenated hydrocarbon solvents must never be used with aluminum equipment during spraying, flushing, or cleaning. Read the label or data sheet for the material you intend to spray. If in doubt as to whether or not a coating or cleaning material is compatible, contact your coating supplier. Any other type of solvent may be used with aluminum equipment. |

| | |
|---|---|
| **Product Description / Object of Declaration:** | **IntelliFlow RF2** |
| **This Product is designed for use with:** | Solvent-based and waterborne materials |
| **Suitable for use in hazardous area:** | |
| **Protection Level:** | Not applicable |
| **Notified body details and role:** | Intertek USA<br>7250 Hudson Blvd N STE 100,<br>St Paul, MN 55128, USA |
| **This Declaration of Conformity / Incorporation is issued under the sole responsibility of the manufacturer:** | Carlisle Fluid Technolgies Inc<br>7166 4th St. N.<br>Oakdale, MN 55128 USA |
| **Representative authorised to compile the technical file** | Sales and Marketing Director. CFT UK Ltd<br>1 Avenue de Lattre de Tassigny<br>94736 Nogent, Cedex. France |

## EU Declaration of Conformity

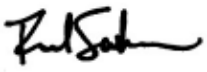
CE

**This Declaration of Conformity / Incorporation is issued under the sole responsibility of the manufacturer:**

Machinery Directive 2006/42/EC
EMC Directive 2014/30/EU
RoHS Directive 2011/65/EU
by complying with the following statutory documents and harmonised standards:
EN ISO 12100:2010 Safety of Machinery - General Principles for Design
EN 60204-1:2006 Safety of Machinery - Electrical Equipment of Machines - General requirements.
BS EN 61000-6-2:2019 Electromagnetic Compatibility Generic Standards Immunity for residential/commercial/light industry environments
EN 63000: 2018 Technical documentation for the assessment according to REACH
BS EN 61000-6-4:2019 Electromagnetic Compatibility (EMC) - Generic standards - Emission standard for industrial environments

Providing all conditions of safe use / installation stated within the product manuals have been complied with and also installed in accordance with any applicable local codes of practice.

Signed for and on behalf of Carlisle Fluid Technologies:



F. A. Sutter

1-Dec-21

Executive President: Engineering and Operations, Scottsdale, AZ, 85254. USA

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# INTRODUCTION—AUTOMATIC

The IntelliFlow RF2 (or RF2) is a standalone system designed to control material delivery from a supply source (pressure pot or circulation system) to an applicator. It accurately controls material mixture ratio and/or material flow in a coating process, which can include single component, 2k, or 3k materials, and handles flushing and loading of the materials.

The RF2 can include up to four fluid channels (for additional details on Channels, refer to page 14 of this manual) which can be arranged in many ways. The available channels can be configured into 1, 2, or 3 component mixes (guns), using any combination of these mixes to utilize all the available channels. The RF2 can be configured to include anywhere from 32 to 128 solenoids, all of which are fully addressable to be used in various ways to control the process (examples include applicator triggers, dump, solvent flush, color-valve selects, etc.).

The channels and fluid mixes can be grouped into up to two stations with individual sets of color stacks, which can be controlled completely independently of one another.

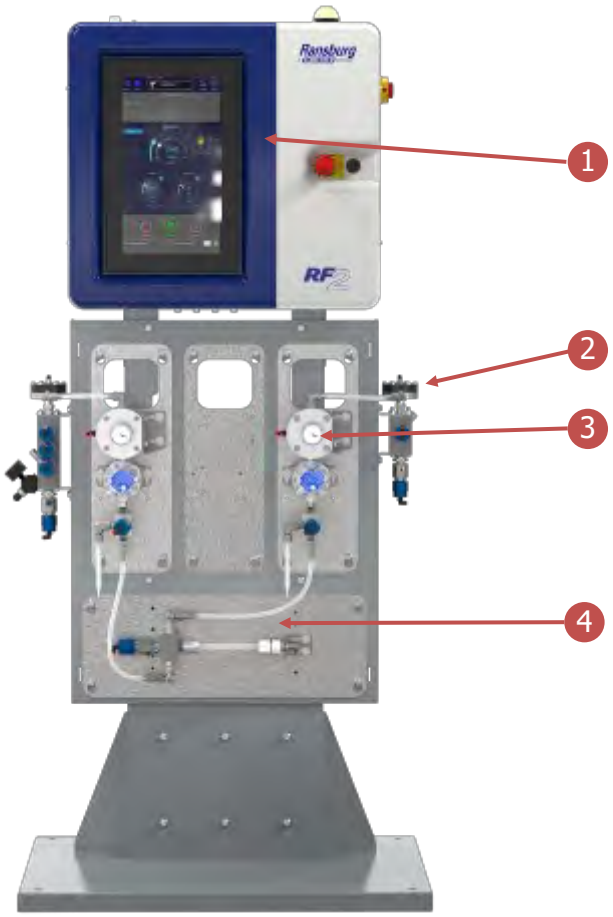
The RF2 can be operated locally, from its included 15-inch touch screen, or it can be easily integrated into an automated process by use of discrete signals for simple systems or by multiple different industrial fieldbus protocols for more advanced control.

The RF2 can be connected to the cloud, allowing access to Carlisle Fluid Technologies technical experts for the purpose of remote troubleshooting. This access may also be granted to local plant personnel.

Data gathered by the RF2, including alarms and flow-totalization data is stored in an onboard SD card, and can be accessed via FTP, or other methods.

## SYSTEM COMPONENTS

1. Control panel
2. Valve stacks
3. Fluid control module
4. Mixing module

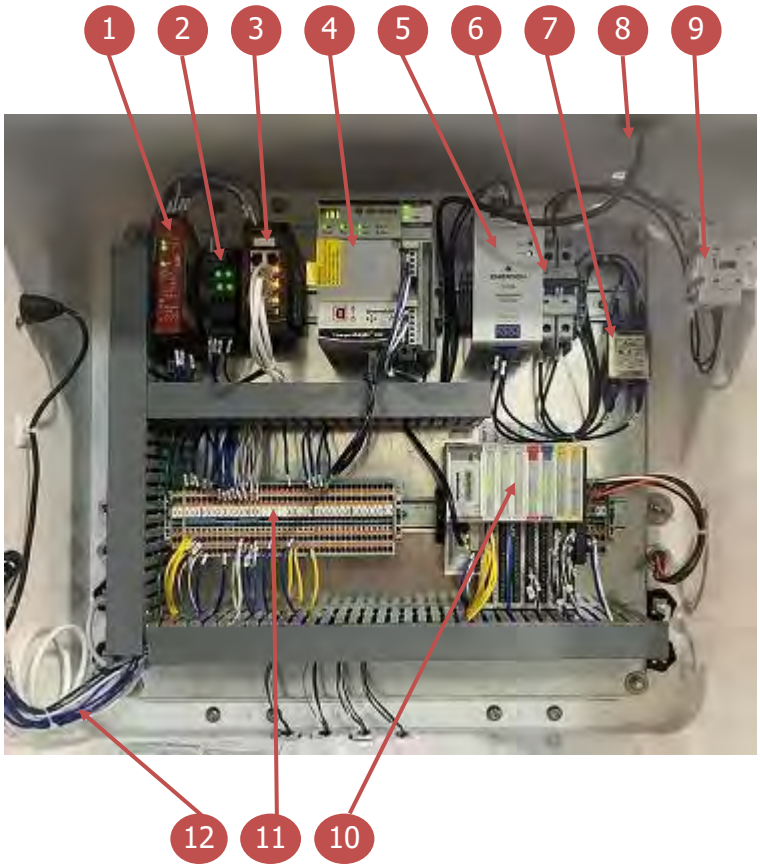


# CONTROL PANEL

## External Components


1. Status light
2. Main power entry
3. Main power disconnect switch
4. Panel opening latch
5. Emergency stop button
6. HMI

## Internal Components

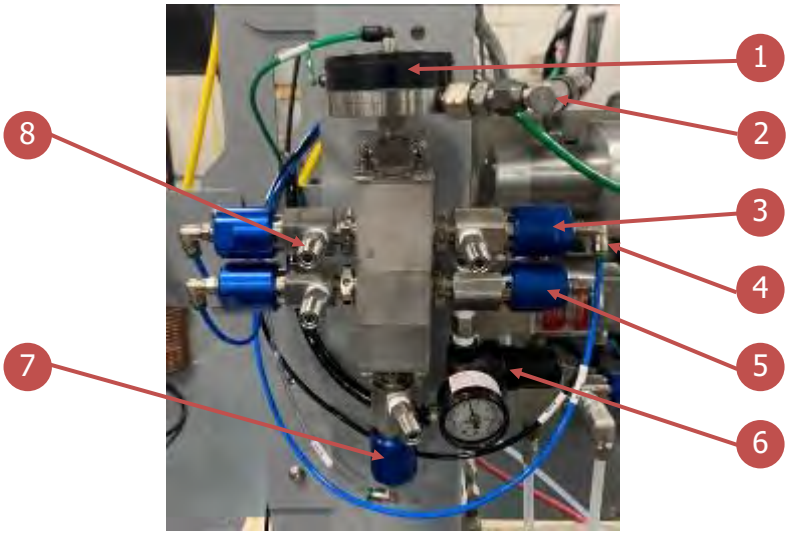



1. Safety relay
2. Electronic circuit protector
3. Local ethernet switch
4. CPU/Controller
5. DC Power supply
6. Main power circuit breaker
7. Line filter
8. Connection to status light
9. Main power disconnect switch connector
10. I/O block and additional terminals
11. Terminal blocks
12. Connection to HMI and emergency stop button

## FLUID COMPONENTS

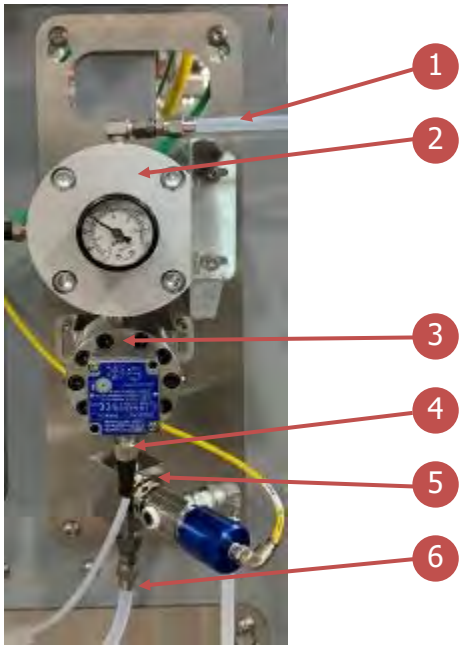
### Valve Stack

1. Fluid pressure regulator (Optional)
2. Connection to fluid panel
3. Fluid valves
4. Connection to solenoids
5. Air push valve
6. Air regulator
7. Solvent flush valve
8. Check valve



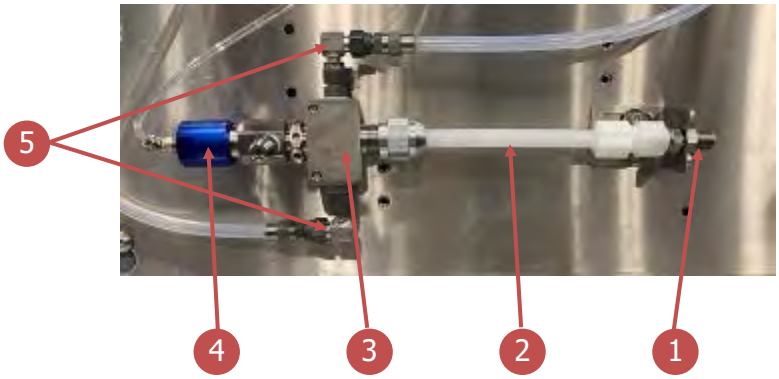

### Flow Control Module

1. Connection to valve stack
2. MVR (Material Valve Regulator) with air gauge
3. Flow Meter
4. Connection to control panel
5. Calibration block
6. Connection to mix module




### Mix Manifold

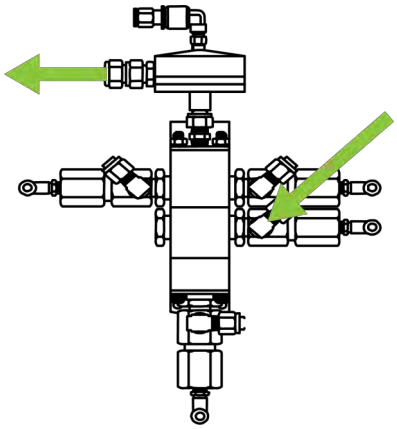
1. Connection to gun
2. Static mix tube
3. Mix block
4. Solvent flush valve
5. Connections to flow control modules



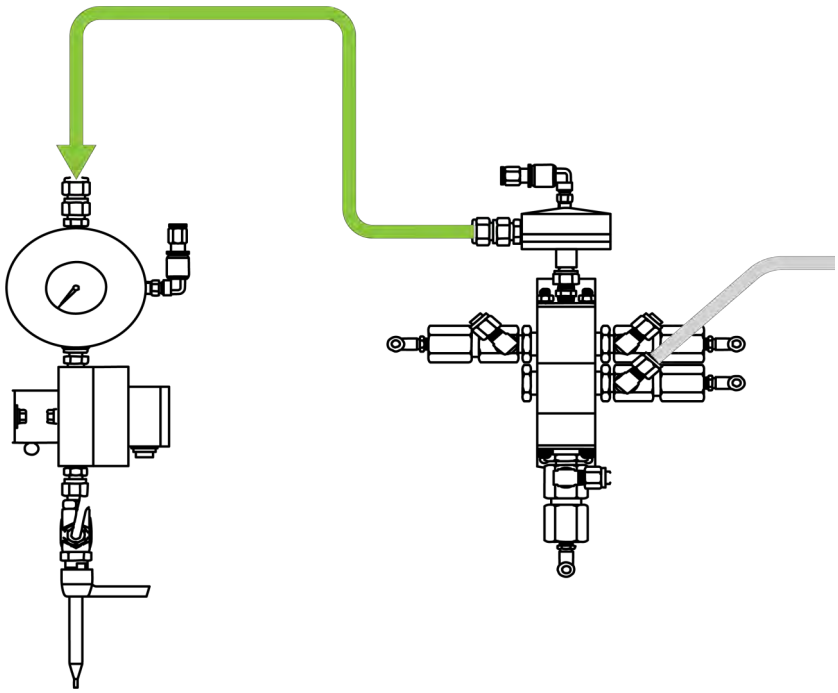
## THEORY OF OPERATION

The RF2's operating principle is as follows:

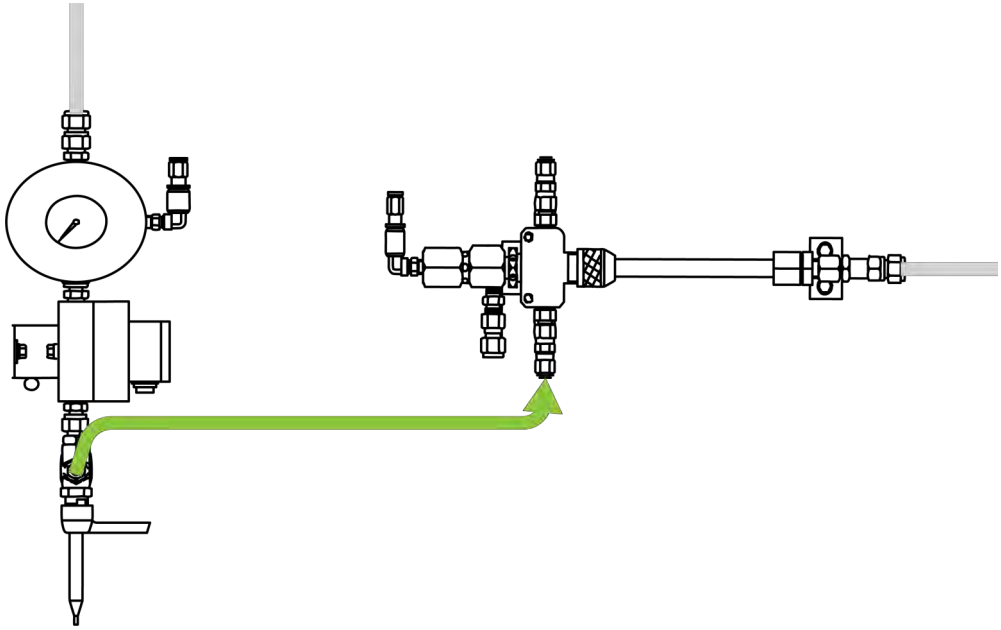
1. The material is fed through the hoses towards the material valves in each stack.
2. If multiple materials of the same type (Resin, Hardener, or Reducer) are being used, each valve will control its flow separately.



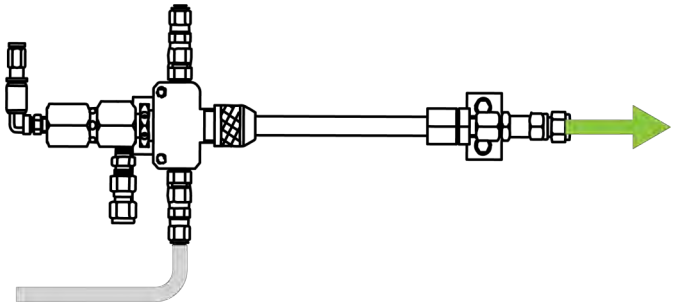
3. The material valves are normally closed. When material flow is needed, the system controller opens the valve via the solenoid addressed to it.



4. The material flows from the valves to the flow control module.
5. The flow meter sends a signal to the control panel indicating the material's current flow rate.
6. The control panel determines if the flow rate is within specification or not.
7. Through the MVR, the control panel increases or decreases the flow rate of material passing through, to reach the desired value.



8. The material proceeds to the mix manifold where it combines with the second and/or third material.



9. The mixed material then flows to the gun's inlet connection.

# RF2 AUTOMATIC SYSTEM CONFIGURATION

***Air hosing***

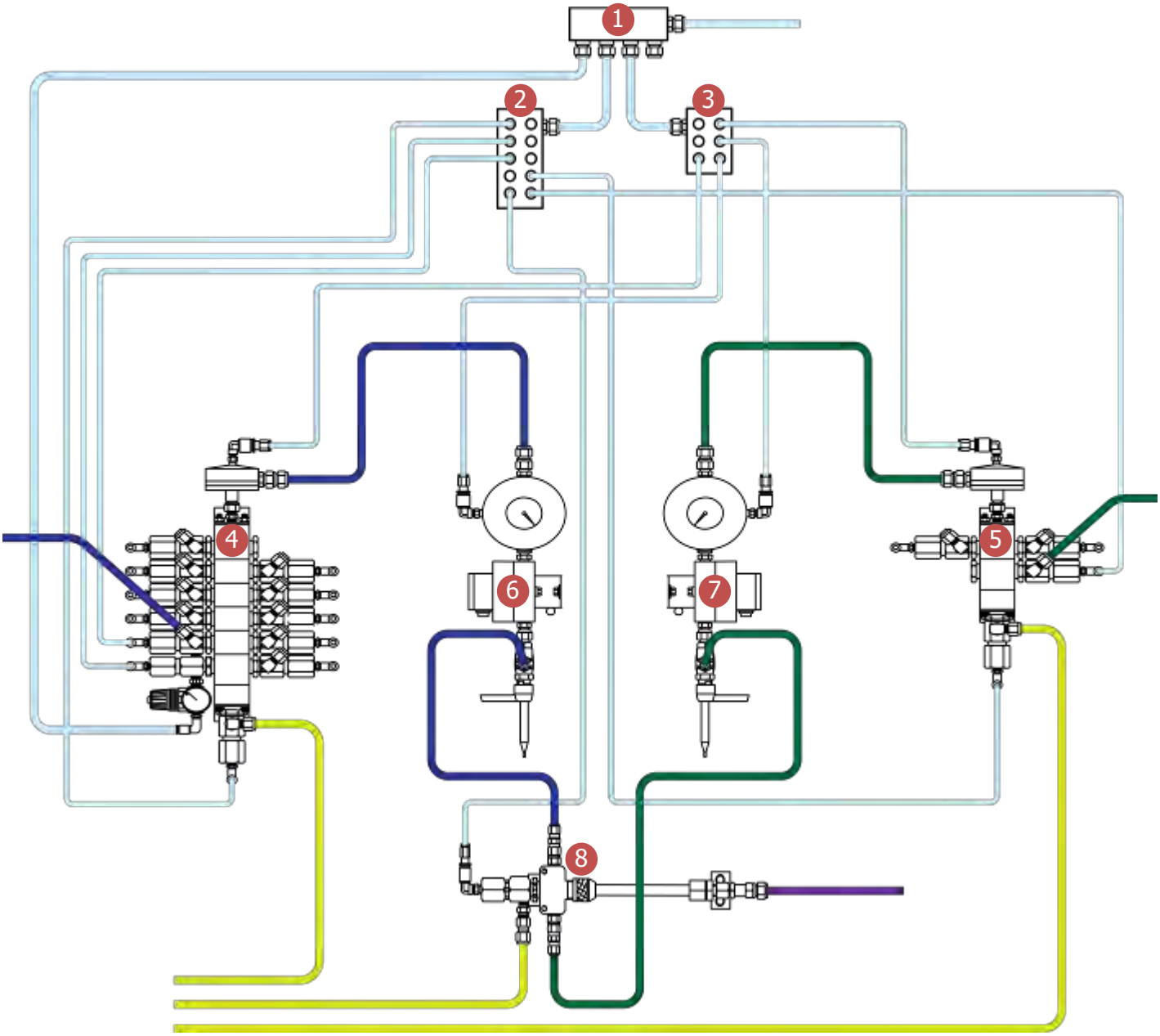
***Solvent hosing***

***Material A lines***

***Material B lines***

***Mixed material lines***

1. Air manifold
2. Valve stack solenoid manifold
3. Pressure solenoid manifold
4. Material A valve stack
5. Material B valve stack
6. Material A fluid panel
7. Material B fluid panel
8. Mix chamber



# INTRODUCTION—MANUAL

The IntelliFlow RF2 (or RF2) is a standalone system designed to control material delivery from a supply source (pressure pot or circulation system) to an applicator. It accurately controls material mixture ratio and/or material flow in a coating process, which can include single component, 2k, or 3k materials, and handles flushing and loading of the materials.

The RF2 can include up to four fluid channels (for additional details on Channels, refer to page 20 of this manual) which can be arranged in many ways. The available channels can be configured into 1, 2, or 3 component mixes (guns), using any combination of these mixes to utilize all the available channels. The RF2 can be configured to include anywhere from 32 to 128 solenoids, all of which are fully addressable to be used in various ways to control the process (examples include applicator triggers, dump, solvent flush, color-valve selects, etc.).

The channels and fluid mixes can be grouped into up to two stations with individual sets of color stacks, which can be controlled completely independently of one another.

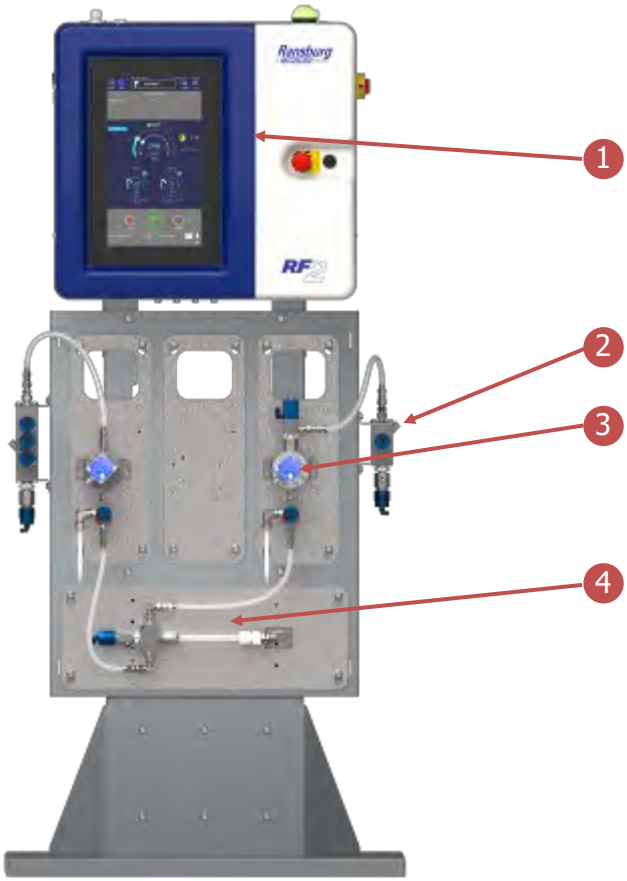
The RF2 can be operated locally, from its included 15-inch touch screen, or it can be easily integrated into an automated process by use of discrete signals for simple systems, or by multiple different industrial fieldbus protocols for more advanced control.

The RF2 can be connected to the cloud, allowing access to Carlisle Fluid Technologies technical experts for the purpose of remote troubleshooting. This access may also be granted to local plant personnel.

Data gathered by the RF2, including alarms and flow-totalization data is stored in an onboard SD card, and can be accessed via FTP, or other methods.

## SYSTEM COMPONENTS

1. Control panel
2. Valve stacks
3. Fluid control module
4. Mixing module

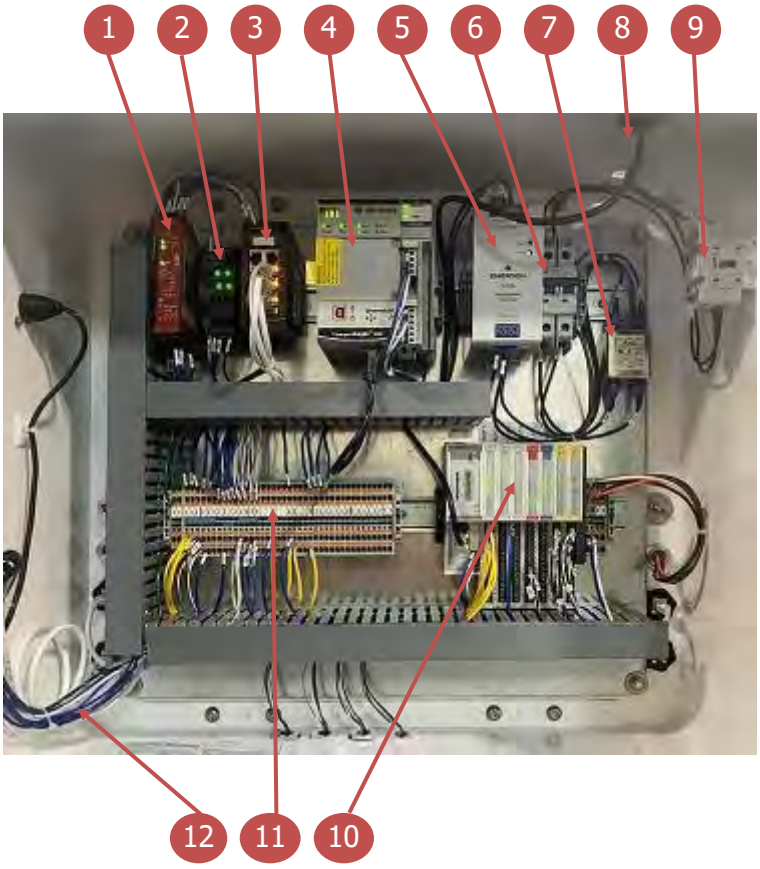


# CONTROL PANEL

## External Components


1. Status light
2. Main power entry
3. Main power disconnect switch
4. Panel opening latch
5. Emergency stop button
6. HMI

## Internal Components

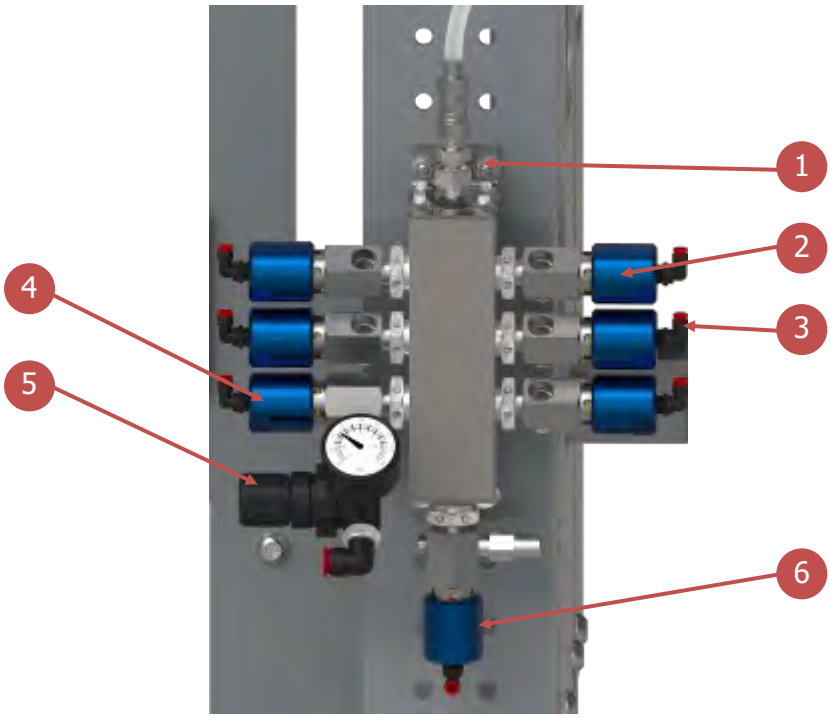



1. Safety relay
2. Electronic circuit protector
3. Local ethernet switch
4. CPU/Controller
5. DC Power supply
6. Main power circuit breaker
7. Line filter
8. Connection to status light
9. Main power disconnect switch connector
10. I/O block and additional terminals
11. Terminal blocks
12. Connection to HMI and emergency stop button

## FLUID COMPONENTS

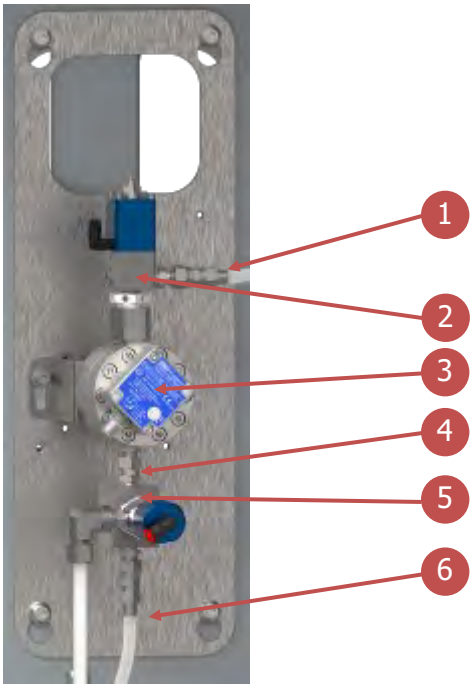
### Valve Stack

1. Connection to fluid panel
2. Fluid valves
3. Connection to solenoids
4. Air push valve
5. Air regulator
6. Solvent flush valve

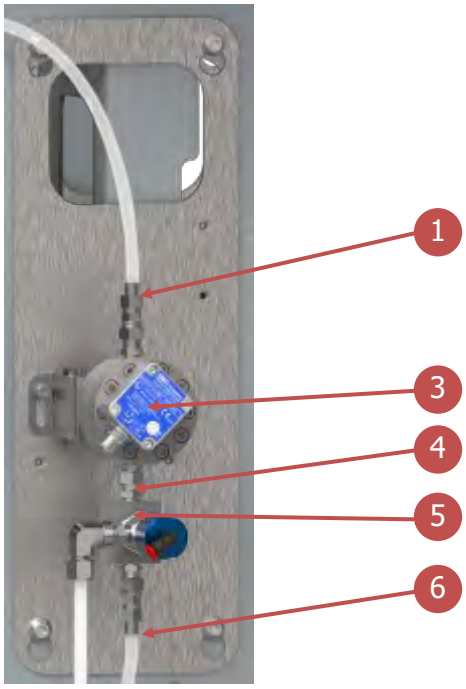



### Pulse Valves

1. Connection to valve stack
2. Pulse valve
3. Flow meter
4. Connection to control panel
5. Calibration block
6. Connection to mix module




Component B & C




Component A

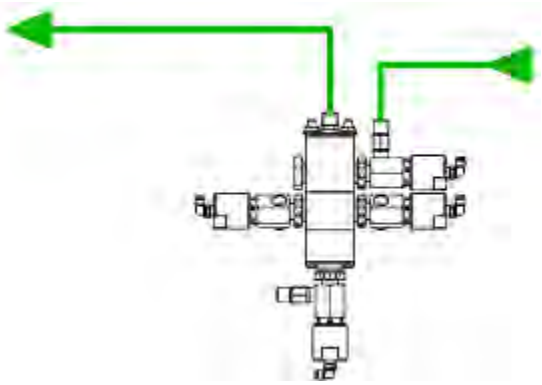
## THEORY OF OPERATION

The RF2's operating principle is as follows:

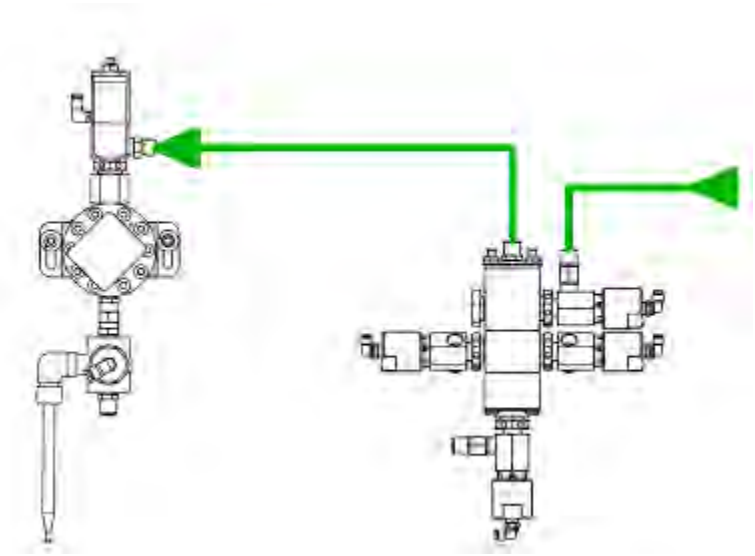
In RF2 manual gun configurations with a pulse-valve channel type for the B and/or C components, fluid from the hardener or reducer channels is "dosed" into the mixture in order to accurately control the material ratio. The rate of pulsing and length of each pulse of fluid is regulated in order to achieve the desired ratio.

For optimal performance, the pulse-valve will operate at 3Hz rate of fire, and all adjustments by the controller will be through varying the length of each pulse. To achieve this, adjust the pulse-valve so the flow through the valve when it is open is at 3Hz rate. Further instructions for adjusting the pulse-valve are

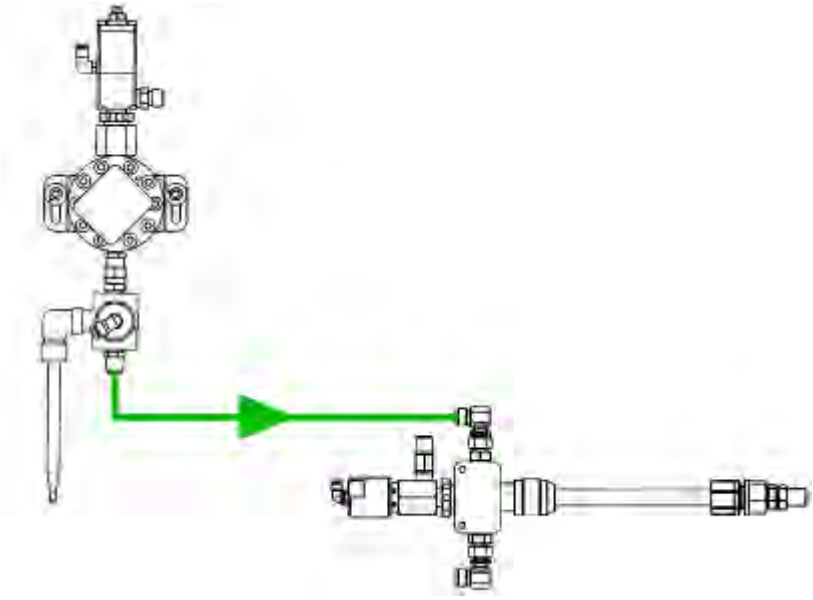
1. The material is fed through the hoses towards the material valves in each stack.
2. If multiple materials of the same type (Resin, Hardener, or Reducer) are used, each valve will control its flow separately.



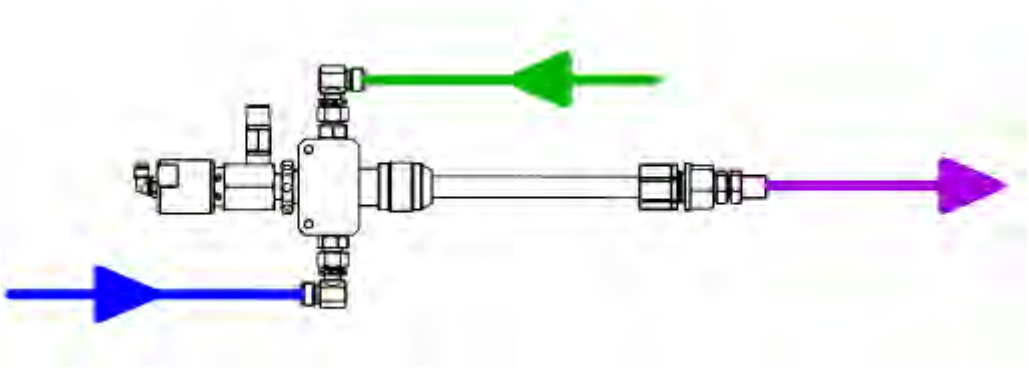
3. The material valves are normally closed. When material flow is needed, the system controller opens the valve via the solenoid addressed to it.



4. The material flows from the valve to the flow meter.
5. The flow meter sends a signal to the control panel indicating the material's current flow rate.
6. The control panel determines if the flow rate is within specification or not.
7. Through the pulse valve, the control panel increases or decreases the flow rate of material passing through, to reach the desired value.



8. The material proceeds to the mix manifold where it combines with the second and/or third material.



9. The mixed material then flows to the gun's inlet connection.
10. If needed, the system can flush only mixed material through the mix manifold, or through the valve stack for color changes.

# RF2 MANUAL SYSTEM CONFIGURATION

***Air hosing***

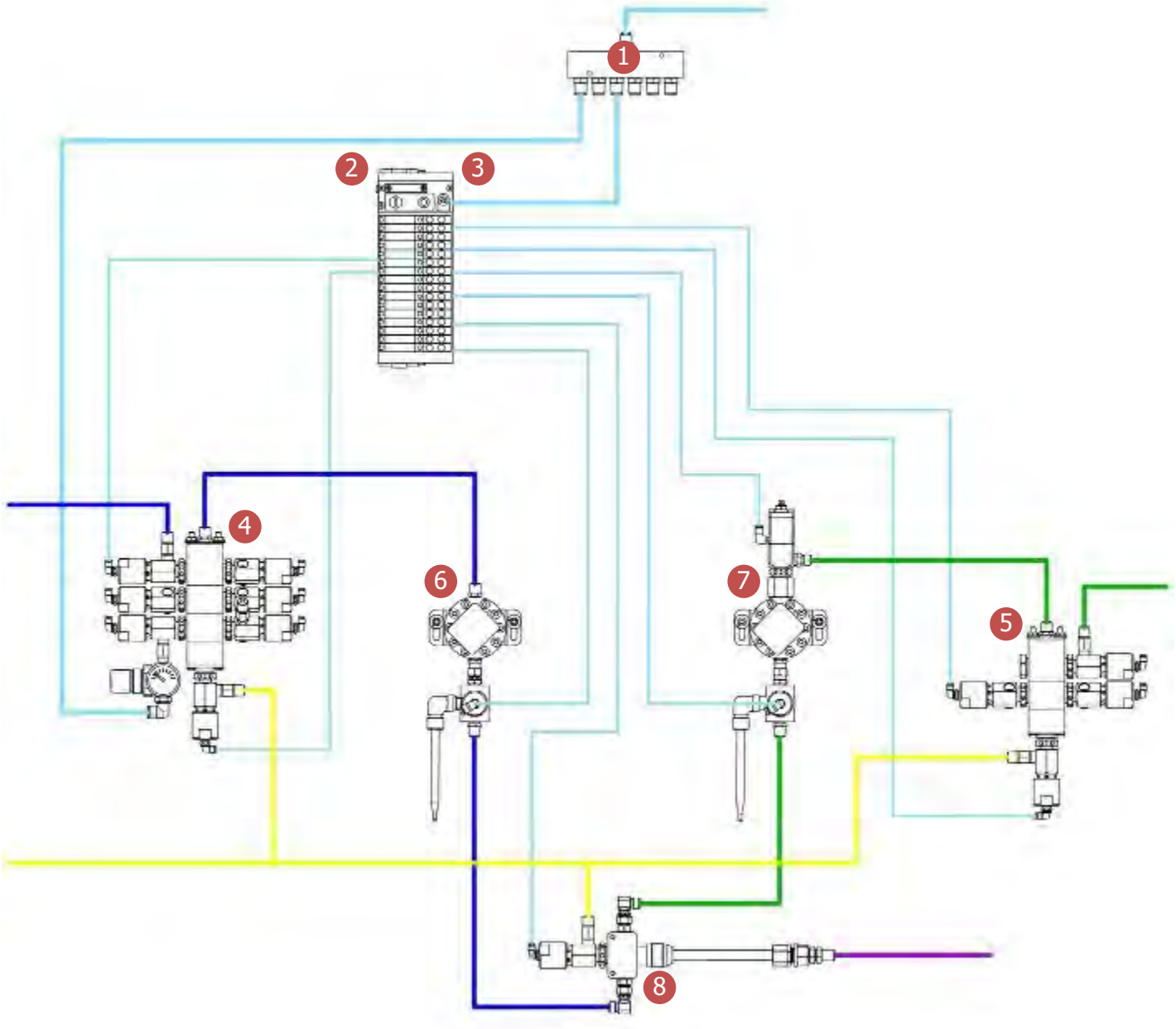
***Solvent hosing***

***Material A lines***

***Material B lines***

***Mixed material lines***

1. Air manifold
2. Valve stack solenoid manifold
3. Pressure solenoid manifold
4. Material A valve stack
5. Material B valve stack
6. Material A fluid panel
7. Material B fluid panel
8. Mix chamber



# INTRODUCTION

The RF2 is a versatile system that can be configured in many ways. This section details the terminology of the various components that make up the system and process.

It should be noted, that although the following is relatively complex, the vast majority of RF2 units will be factory-configured based on the fluid components that were purchased, and will only require slight modifications, if any, before operating the system.

## TERMINOLOGY

In demonstrating the ways to configure and operate the RF2, the following terminology will be used throughout the manual.

### Outputs

Outputs are either (1) discrete signals that are assigned to pneumatic solenoids (up to 128 can be controlled by the RF2 via four separate manifolds) or (2) hardwired digital signals.

Outputs can be configured as several types:

- Color Valve (CCV)–used on a material stack to select different materials. Each CCV output has a number associated with it for the valve number on the color stack.
- Dump–output is used as a dump, which operates much like a trigger. The system expects flow when this is active.
- Flow Control Pulse–used as a flow control method for manual configurations that use a pulsing channel. Assigned to a specific channel.
- Flow Test–used by each channel as an automated calibration port.
- FL. OVRD. (Fluid Override)–used when a DR-1 or HGB air-piloted fluid regulator is used as the flow control device. Fluid override port forces the unit open for cleaning. The flow control functionality is stopped.
- Material Select–used on a mix manifold to allow or disallow a material channel from entering the mixed section.
- Pass Through–allows the user to assign a solenoid to a user-defined input, basically giving direct control of the solenoid to external processes.
- Sequence–output used in flush, load, and other fluid sequences.
- Standard–output is active during a sequence but has no particular effect on flow control (examples are solvent and air valves).
- Trigger–starts an applicator
- Unused

## Functions

Functions of different types are assigned to the programmed outputs and operate on them in different ways. Functions are called during fluid sequences. Types are:

- Unused
- Simple–output assigned to the function is active while the function is active during a fluid sequence.
- Latch–when the function is activated during a fluid sequence, the output assigned to the function turns on and holds on until an unlatch command is given.
- Unlatch–opposite of latch example: when the function is activated during a fluid sequence, the output assigned to the process turns off and stays off.
- Chop–this function contains two outputs, and when active, alternates between the two. This is typically used with stack solvent and air solenoids.
- Pulse–the assigned output turns on for a set period (programmable) when the function becomes active.
- Wait–(future feature)–the function causes the fluid sequence to pause until the assigned input is true.

Functions can be made available to any of the available fluid sequences.

## Sequences

A sequence consists of twelve steps with programmable times per step. During each step, specific functions can be activated or deactivated, causing their outputs to react according to the function setup.

## Channel

A channel is a single flow-control path for fluid. Channels can be grouped together to build a gun or mixer. The RF2 controller can handle up to four channels.

Channels have multiple possible configurations – options include:

- Flow Control Type
    - MVR–the channel uses a 0-100psi pressure pilot signal to control an MVR (Material Volume Regulator) to control flow.
    - DR1–the channel uses a 0-100psi pressure pilot signal to control a DR1 pressure regulator to actuate flow.
    - Gear Pump (Future)–the channel uses a gear-pump to actuate flow.
    - Pulse–for manual slave channels only–the channel uses a pulsing valve to regulate the ratio of the mixture–note in manual applications, flow control is carried out by the handgun.
    - Feedback Only (Future)–for manual master channels only–no flow regulator is used.
- Feedback Type
    - Square Wave–a flow meter that produces a quadrature signal is used for reading flow.
- Inlet Pressure Regulation
    - Enabled or disabled to control the fluid pressure to the inlet of the flow control device.

## Gun/Mixer

A gun or mix is a combination of 1-3 fluid channels. Depending on ratio setpoints, the flow command of the gun is divided into flow rates for the assigned channels, to accurately mix the material.

Configurations for gun/mixers are:

- Fluid Type
    - Unused, 1K, 2K, 3K.
- Control Type
    - Automatic–an automatic gun is used triggered by an external request of some type. Flow and ratio are controlled.
    - Manual Pulse–a manual gun is controlled using pulse channels to modulate the secondary materials. Only ratio is controlled.

The RF2 can have up to four gun / mixers configured. Note that these can be built out of only four channels, and each channel can only be assigned to one mixer. There can only be two 2k mixers, but there can be four 1k mixers.

## Station

A station is a collection of guns/mixers–up to four, which are built from their assigned channels, and several outputs and fluid stacks. The RF2 can control up to two stations with independent color stacks to make it a two-applicator controller.

Configuration of Stations and Guns must be built out of the components available–four fluid channels and up to 128 solenoid outputs.

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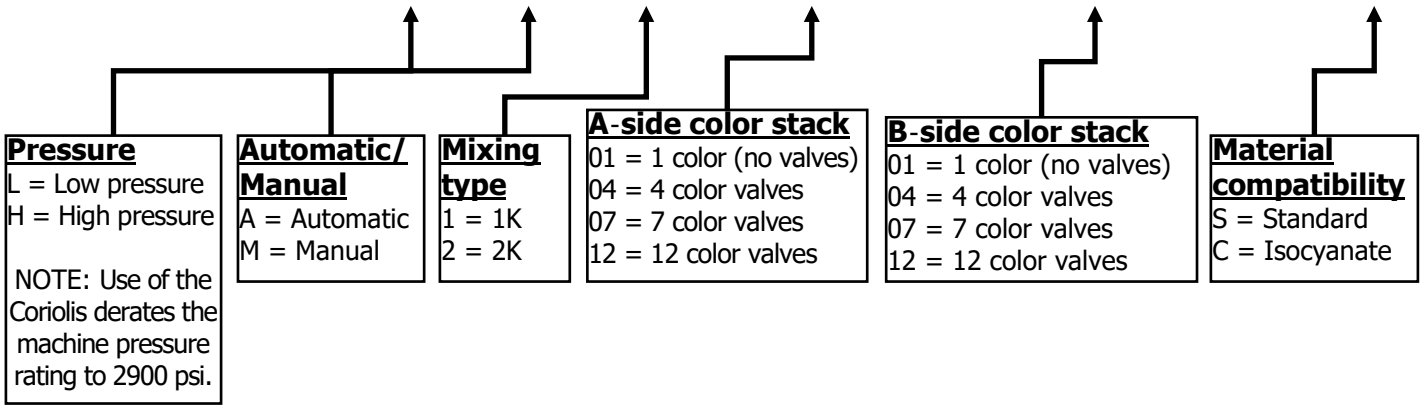
## COMPLETE SYSTEM PART NUMBERING

RF2 -# # #-# #-# #-# #-#




## TECHNICAL SPECIFICATIONS

| ITEM | DETAILS |
|---|---|
| Dimensions | Main control console: 24”x 24”x 10”<br>Pneumatic interface panel: 24”x 12”x 9” |
| Weight | 150-250 lb (Depending on added components) |
| Operating temperature | 40˚F to 122˚F (5-50˚C) inside enclosures<br>100˚F (38˚C) maximum ambient temperature |
| Operating humidity | 5% to 85% RH (non condensing) |
| Environmental conditions | Indoor use, pollution degree 2, installation category II |
| Air input pressure | 75 to 105 PSI (5.17-7.24 BAR) |
| Air filtration | 5 micron or better, -40˚F (-40˚C) dew point |
| Ratio tolerance | < = 1% (Ratio accuracy can be affected by process factors such as hardware configuration, extremely low flow rates, etc.) |
| Mixing ratio range | 1:1 to 50:1 |
| Power input | 85-264 VAC<br>0.8A @ 115 VAC, 0.4A @ 230 VAC |
| LCD display | 15” True Glass Capacitive Multitouch display, 1366x768 pixels, HD |
| Flow capacity | <10 ml/min to 3500 ml/min per channel (depending on material and flow meter limitations) |
| Viscosity range | <1 cp to >500 cp (depending on flow meter & hardware selected) |
| Fluid filtration | 100 mesh or better (150 micron) |
| I/O update time | 5 ms (200 times/s), Process scan at 10 ms |
| Recipe tables | 250 per station (2 stations available) |
| Wetted parts | 300 & 400 series stainless steel, PTFE, perfluoroelastomer, UHMW polyethylene |

## PROCESS CONFIGURATION

In addition to the multiple configurations of the RF2'sphysical hardware, the flow control processes can vary greatly from one application to another. The RF2 software can be configured through global setup parameters, which affect system behavior independently of the material being used, and through "recipe" parameters, which can be modified per the material in use.

# Recipes

A recipe is a set of material-specific parameters used to govern system operations. Each Station (see above) can store up to 250 recipes. The parameters for each recipe are organized into three groups:

## Materials–parameters that apply to the system as a whole

- Channel A (Resin)–CCV Number–the color valve assignment for the resin stack for the selected recipe.
- Channel B (Catalyst)–CCV Number–the color valve assignment for the catalyst stack for the selected recipe. Available only for 2 or 3 component materials.
- Channel C (Reducer)–CCV Number–the color valve assignment for the reducer stack for the selected recipe. Available only for 3 component materials.
- Pot-Life Time–the amount of time, in minutes, that a mixed material can remain in the line before it must be flushed from the system. This dictates the pot-life warning alarm. Setting this to zero disables the feature.
- Ratio (A, B, C)–the ratio for 2 or 3 component mixers. A: B (resin: catalyst) are given in parts–Channel C is given in percentage of total flow.
- Sequence Assignments:
    - Flush A Only–programmable sequence number that is run when a "purge A only" command is given. This occurs when a new material is loaded that uses the same catalyst and reducer.
    - Flush All–programmable sequence number that is run when a "purge all" command is given. This occurs when a new material is loaded, requiring either a change in catalyst or reducer.
    - Load–programmable sequence number that is run when a "load" command is given. This occurs when a new material is loaded, after any necessary purges have been completed.

## Gun/Mix–parameters that apply to the gun or mixers that are used by the station selected

- Trigger-On Delay–when a trigger occurs, the applicator trigger solenoid opens this amount of time prior to the actuation of flow.
- Trigger-Off Delay–when a trigger stops, the applicator trigger solenoid will remain on for this amount of time after flow has been shut down.
- MVR Hold–for channels that use an MVR type controller, the MVR will hold at its previous value after a "trigger-off" event for this amount of time, before returning to the "minimum control pressure" value.
- Minimum/Maximum Flow–these parameters scale an optional analog (0-10V or 4/20mA) flow command between these values. These parameters are also used to scale the gauges on the main status screen showing the flow feedback.

- Default Flow–if no flow command is given by either fieldbus signal or analog input, this flow will be used.
- Sequence High Flow Rate–optional higher flow rate for when "Max Flow" system output is active.
- Flow Rate Tolerance–the percentage error in flow rate for the gun/mixer or any of its channels that is tolerable.
- Flow Rate Tolerance Time–the amount of time that the flow rate must be out of tolerance before a flow rate tolerance alarm will occur.
- Ratio Tolerance–the percentage error in mixture ratio that is tolerable.
- Ratio Tolerance Volume–the amount of volume that the ratio is measured over before producing a ratio alarm.

## Channel–parameters that apply to the individual fluid channels used by the mixer selected

- Flow Calibration:
    - For quadrature flow meters–the number of pulses per liter. There are four pulses per flow-meter cycle, so if a flow meter is rated for 14000 cycles / liter, the pulses per liter = 56000.
    - For analog flow meters–given in a simple scaling (In High, In Low, Scaled High, Scaled Low)

      NOTE: Flow calibration can be done by an automated process, in which a measured output of material can be inputted and compared with the counts during a calibration cycle to fine-tune the calibration for different materials. See more about flow calibration below.
- Flow Control PID parameters:
    - Kp/Ki–the P and I components of the PID which govern flow control. While these may need to be adjusted slightly based on different materials and nominal flow rates, good numbers to start with are 2000 and 150.
    - C-band–given in cc/min–if the flow rate error is greater than this, than the Flow control PID Kp value will be multiplied to give a faster response.
    - I-Band–given in cc/min–if the flow rate error is greater than this, the Ki value will be multiplied to give a faster response.
    - For C-band and I-band, a setting of 5-6 will suffice for higher flow rate channels. For lower flow rate (typically catalyst) channels, a lower setting may be used. If too low of a setting is used, it may cause oscillations in flow rate and unstable operation. A zero setting disables this feature.
- Minimum Control Pressure–this is the lowest pressure that an MVR pilot valve will operate. This should be set at slightly below the "cracking pressure" of the MVR to give a faster response. Typically with weep-less MVRs, a value of 10 psi is used. Weeping MVRs use a value closer to 20 psi.
- MVR Enable–this feature, available only when an MVR is used for the flow control of a channel, allows the channel's color valves to shut off when no trigger exists.
- Inlet Pressure Control–if inlet pressure regulation is used, this is the pressure that the channel will operate. Note: In gear-pump systems, this value represents the "delta" above or below the outlet pressure of the pump.

# Global parameters

Global parameters affect operation independently of the material(s) being used. These are organized into several groups:

## Gun/channel parameters

- Mixed Volume–given in cc or mL, the volume of tubing between the mix block and the applicator. This is used to track material pot-life time.
- Blowoff Time–for manual guns only, this time elapses as the gun trigger is detected (through installed air-flow switches utilizing the Manual Gun/Flux Box interface kit). If the set time elapses before flow is detected, a "No Master Pulses" alarm will occur.
- Default Flow Meter Calibration–PPL or Analog scaling values – in the event a recipe is loaded that has not been appropriately defined, these values will be used in calculation of actual flow rate.
- Inlet/Outlet Pressure Scaling–used to calculate inlet and outlet pressures from pressure sensors. Used only with gear-pump systems.
- Reverse Flow Volume–the amount of volume (cc or mL) that is allowed before a fault is generated–this is used to protect against stuck check valves that might allow material to feed backward in circulation lines.

## Alarm masking

- This allows various alarms to be used as warning only or "spray-shutdown" alarms that halt the system.

## Fluid system setup

- Outputs–defines the description, type, and interlocks for each output in the fluid system. See more about configuring the fluid system below.
- Functions–defines the description, function type, outputs acted upon. Sequences which use the function are defined here. See more about configuring the fluid system below.
- Sequence–defines the description, whether the sequence is used or not in the system, and global times for "chop air" and "chop solvent." See more about configuring the fluid system below.
- Sequences–defines timing and which functions are active per step in each fluid sequence.

## Display preferences

- "Show Summary Page On Startup"–when enabled, shows a configuration summary page for the system when powered up.
- Flow Totals Units–Liters or Gallons–units for material total display.
- Pressure Unit–PSI or Bar–units for pressure display.
- Default Max-Y Values for Flow Trend Displays–when a trend display is open, it will revert to this value for scaling the flow feedback.
- Language: Language shown on the display.

Note some items that are defined by user entry will not be translated, but these values are editable by the user.

## Security

The system administrator has access to settings not available to other users. This includes the ability to add, delete, or modify users, as well as the ability to assign access to various features to different user groups (levels 1-10).

Functions that can be access-controlled are:

- Edit Recipe: User can enter the recipe edit menu and make changes.
- Copy Recipe: User can copy recipe parameters from one location to others.
- Setup Menu: User can access the global setup menu (besides administrator only functions).
- Edit Fluid System: User can access fluid system configuration pages (Sequence Definition, Function Definition, Output Setup).
- Edit Fluid Sequences: User can modify sequence timing for sequences that have been defined.
- Edit Active Flow Settings: User can modify the active parameters (recipe driven) pertaining to flow.
- Edit Active Mix/Gun Settings: User can modify the active parameters (recipe driven) pertaining to a mixer or gun.
- Edit Active Inlet: User can modify the active parameters (recipe driven) pertaining to inlet pressure.
- Calibrate Flow Meter: User can calibrate the flow meter.
- Hardware Browser: User can access the "hardware browser" page, which gives access via a webpage for various internal system components.
- Local Control: Allows individual functions and solenoid valves to be controlled manually.

# INSTALLATION

Before operating the RF2, Make sure all the below installation steps are complete. Schematics and further information are provided separately from this manual.

**⚠ WARNING**

This equipment is intended to be installed outside of classified hazardous areas. While there are accessories for this equipment, sold separately, which will allow devices such as flow meters to be installed within the hazardous zone, this should only be done following the instructions that are provided with those accessories.

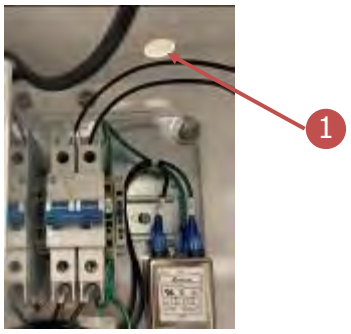
## ELECTRICAL

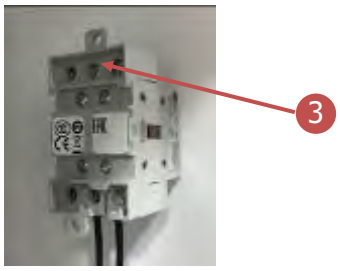
The RF2 can accept either 120VAC or 240VAC as a power source. Its internal 24VDC power supply automatically detects the input voltage and produces control power accordingly.

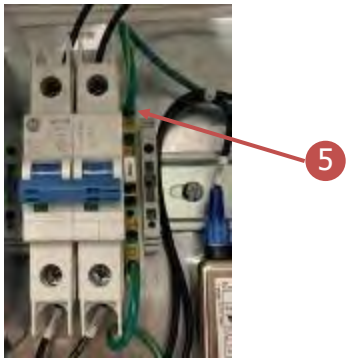
Main power entry to the cabinet is located at the top right-hand side of the cabinet. A 1/2” hole is pre-drilled in the enclosure to accept a conduit or cord-grip, etc.

### Process

1. Locate the main power entry in the upper right section of the cabinet.
2. Using a plug, insert a wire with minimum 16 and maximum 10 gauge into the slot.
3. Locate the disconnect switch connector inside of the control panel.
4. Using the wire, connect the L1 and N lines to the top lugs opposite their secondary connections.
5. Connect ground wire to the ground block in the cabinet.




**NOTE**

Any conductive parts within 2.5m of this equipment (ladders, rails, fences, etc.) shall be bonded appropriately to ground.

## PNEUMATICS

For convenience, all necessary air input connections are centralized in a single manifold, so that incoming air pressure can be managed in one place.

**Always use clean, dry air to operate the RF2.**

**The maximum air input pressure is 105 PSI/7 BAR.**

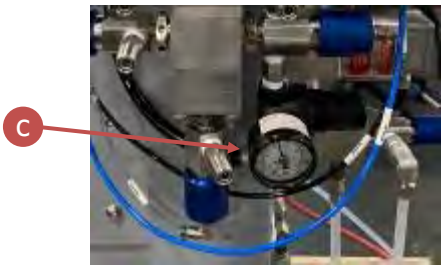
### Pneumatic Connections

1. Locate the air manifold inlet connection at the top right corner of the system chassis.
2. Attach a 3/8" main air line with 1/4" NPS swivel connection to the main air inlet.


**The following steps may have been completed by the factory before shipment.**

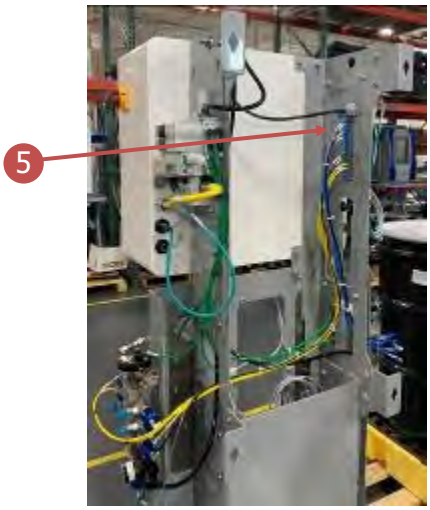
3. On the opposite side of the air inlet, locate the manifold fittings for the interconnected air tubing.
4. Connect the manifold to each destination:
   a. Resin and catalyst solenoid manifold.
   b. Flow & pressure solenoid manifold.
   c. Resin air flush valve.
   d. Depending on your gun type, the gun's air regulator.

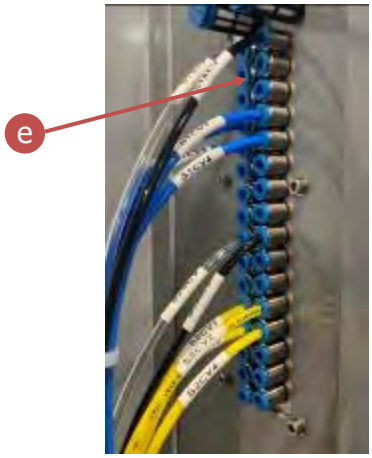


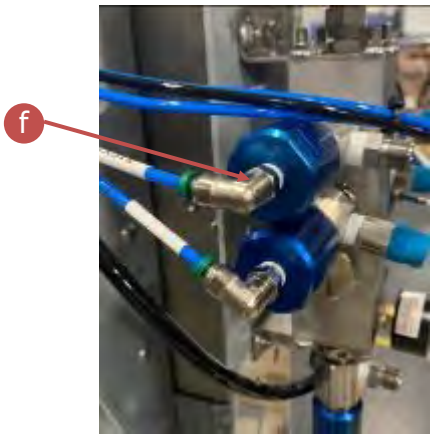



## Resin and Catalyst Solenoid Manifold and Valve Stacks

5. Locate the solenoid manifold on the back left side of the system. This manifold houses all the air outputs to the valve stacks for the three materials.
6. Using the desired mapping, connect the manifold outputs (e) to each resin/catalyst valve (f).



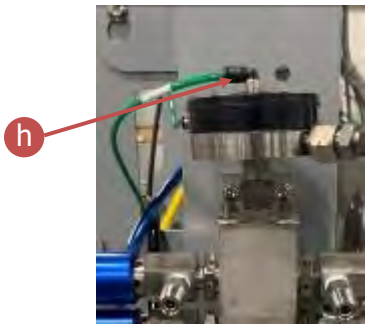



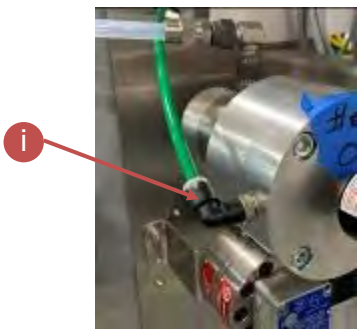




## Flow and Pressure Solenoid Manifold

7. Locate the solenoid manifold on the back right side of the system. This manifold houses all the air outputs for the fluid regulators and MVRs.
8. Using the desired mapping, connect the manifold outputs (g) to each material pressure valve (h).
9. Using the desired mapping, connect the manifold outputs (g) to each MVR (i).



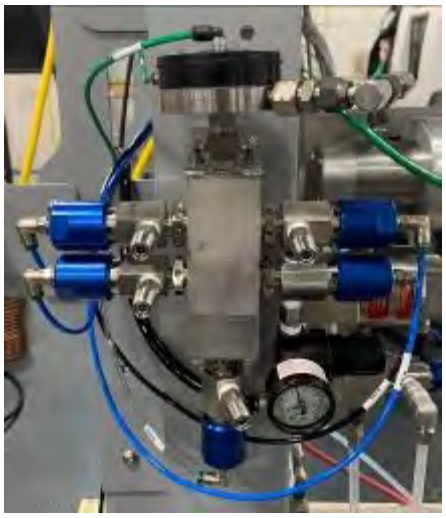


# PAINT MATERIALS

Your system may include up to three valve stacks for three different channels. The process to connect each is the same; repeat the steps below as needed. The number of valves each stack will have depends on your application and needs.

*One stack configuration*



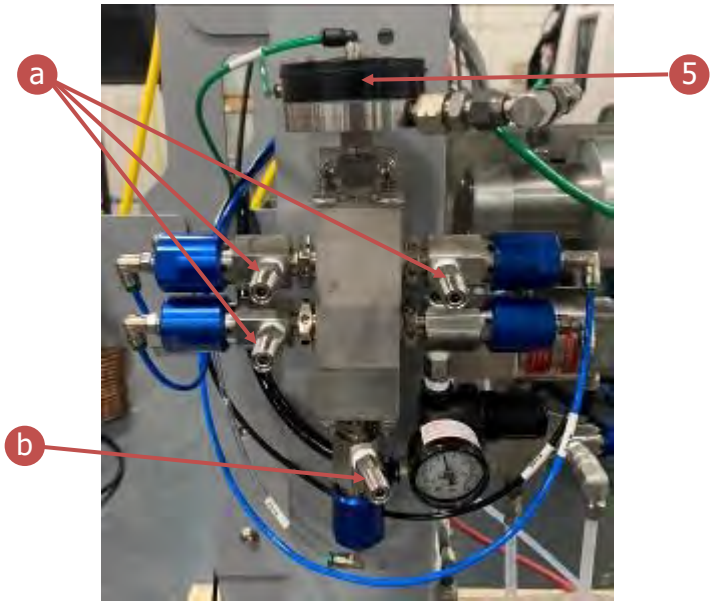
*Two stack configuration*

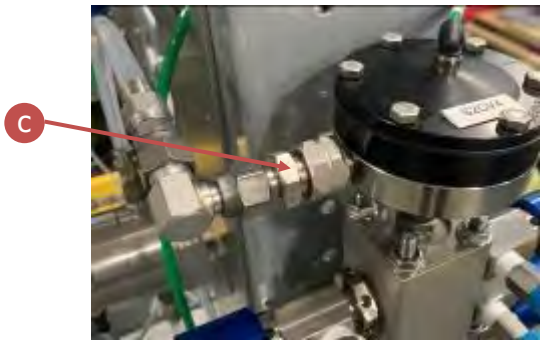
## Paint Material Connections

1. Locate the valve stack you want to connect.

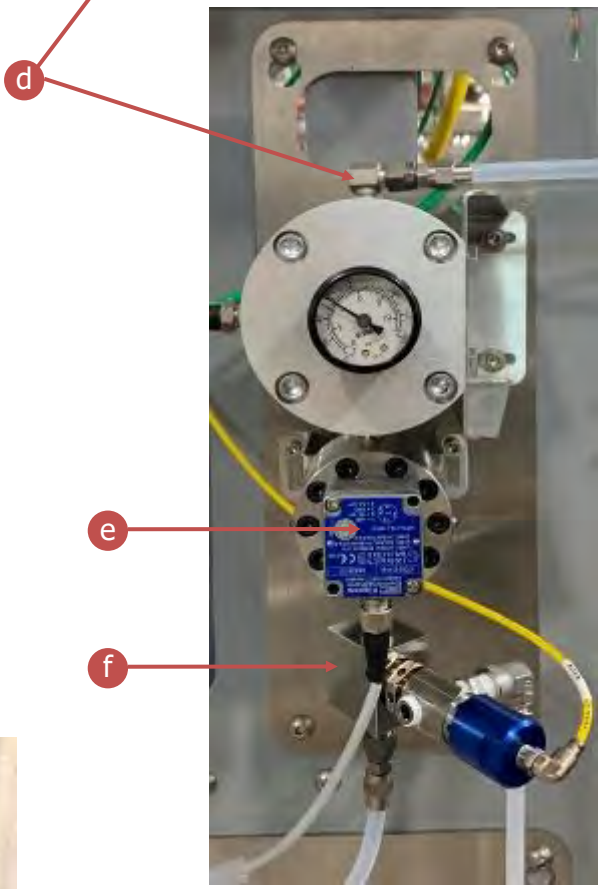
   Either side of the system can have two different stacks with one above the other.

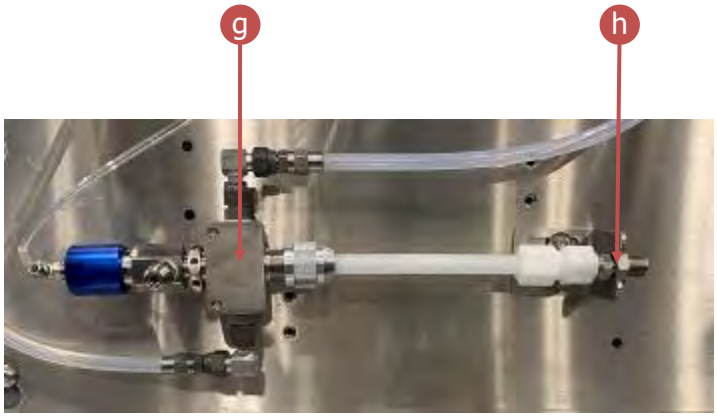
2. Locate each of the material input connections on each valve on the stack (a).
3. Connect your material supply to the material input connection according to your desired mapping. Be careful not to mix different kinds of materials into the same stack. Each material (Resin, Catalyst and Reducer) must have his own.
4. Connect your solvent supply to the input valve below the stack (b).






5. Locate the fluid pressure regulator on the top of the stack.
6. Connect the regulator (c) to the MVR (d) in the fluid panel.
7. Depending on your configuration, connect the flow meter (e) below the MVR to the calibration block (f). If not using a calibration block, skip this step and connect the flow meter to the mixing block (g) directly.
8. If you are using a calibration block, connect it to the mix block (g).
9. Plug your gun's material input to the mixing tube's output connection (h).



# INSTALLATION OF AIR CUT OFF KIT

The air cut off (ACO) kit is installed when the RF2 system is to be used in manual mode. The ACO kit can be used in conjunction with a gun flush box or on its own. The functions of the ACO kit are (1) to control air flow to prevent solvent atomization when using the flush box and (2) to sense air flow through the gun and send a trigger signal to the controller to enable material flow.

The air cut off kit is capable of controlling the air flow for two guns. The first set of connections, labeled with a 1 on the ACO box, is for gun one. The second set, labeled 2, is for gun two. Installing the second set of connections is unnecessary if only using one gun.

The box consists of three main components:

1. Air cut off valves: disable air flow to the guns when flushing them.
2. Flow switches: used to sense when the operator has opened the spray applicator. The trigger signal is fed to the system controller to enable material flow.
3. Gun-in-box (GIB) pressure switches: used in conjunction with the flush box. They send a signal to the controller when the flush box is closed and the gun is ready for flushing.

## Possible Configurations for Air Cut Off Kit

- 310-3905-S0 (for one gun at standard air flowrate)
- 310-3905-L0 (for one gun at low-volume air flowrate)
- 310-3905-LL (for two guns at low-volume air flowrate)
- 310-3905-SS (for two gun at standard air flowrate)
- 310-3905-SL (for two gun, one at standard and one at low-volume air flowrate)

## Parts Included

1. Air cut off box
2. Air cut off valves and associated fittings
3. 10” of 5/32” pneumatic tubing per gun
4. 10 m of M12 cable

## ACO Connections

a. GIB1 (Gun-in-box pressure switch for gun one, 5/32” or 4 mm tube)

b. GIB2 (Gun-in-box pressure switch for gun two, 5/32” or 4 mm tube)

c. M12 cable to controller

d. ACO valve signal gun 1 (5/32” or 4 mm tube)

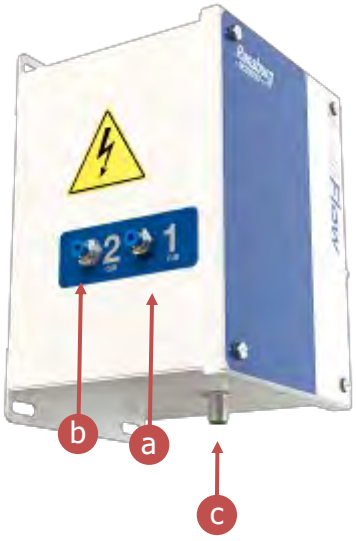
e. ACO valve signal gun 2 (5/32” or 4 mm tube)

f. Atomization air connection to gun 1 (1/4” NPS male)

g. Atomization air connection to gun 2 (1/4” NPS male)

h. Air supply input for gun 1 (1/4” NPS male)

i. Air supply input for gun 2 (1/4” NPS male)




**⚠ WARNING**

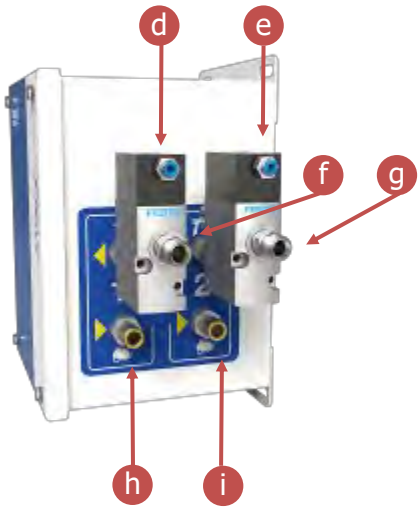
Installation should be performed by a qualified electrician. Improper installation could create a spark, resulting in fire or explosion.

## ACO Kit Installation

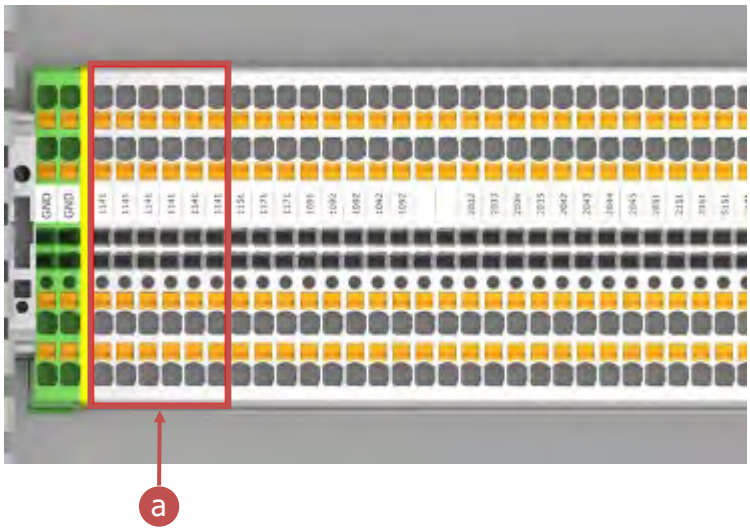
1. Mount the ACO box near the RF2 controller in a non-hazardous location.
2. Next, mount the solenoid valves to the air cut off box, as shown.
3. Route 5/32” pneumatic tubing from the air cut off valve (d and e) to port 10 (trigger g1) and port 11 (trigger g2) on the RF2 solenoid outputs.
4. Connect the air supply inlet to the air supply inputs for gun one and/ gun two (h and i).
5. Connect the atomized air to the atomization air connection for gun 1 and/or gun 2 (f and g). The air supplied to the air supply input for gun one (h) will be output in the atomization air connection to gun one (f).
6. Route the M12 cable from the M12 cable connection (c) and into the RF2 enclosure either (1) through an available strain relief or (2) by replacing the hole plug with the strain relief included with the RF2 controller. See the next page for terminal connections.

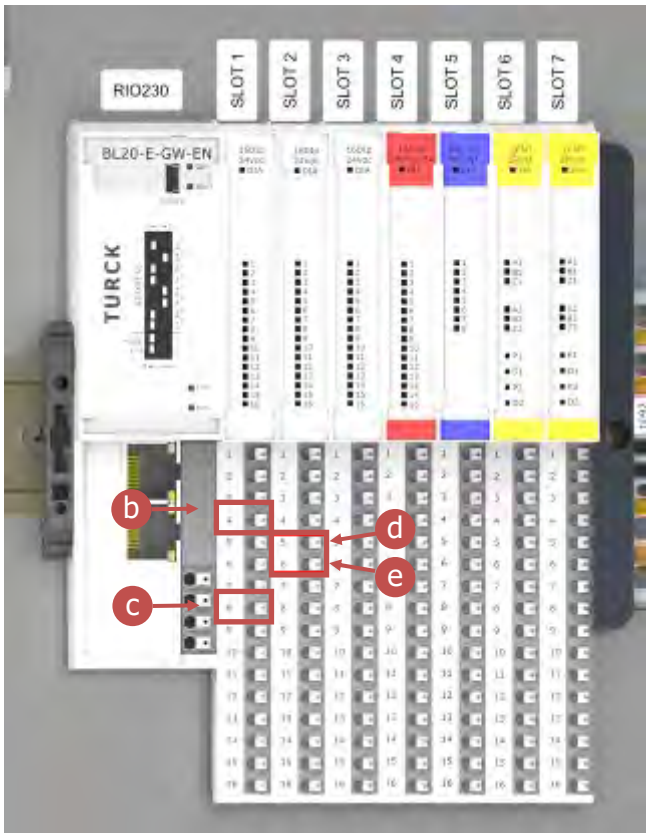
If used with a gun flush box:

7. Route 5/32” tubing from GIB 1 and 2 (a and b) to each respective gun flush box for each gun.



Once the M12 cable from the air cut off box is in the enclosure, connect it to the terminals indicated below.

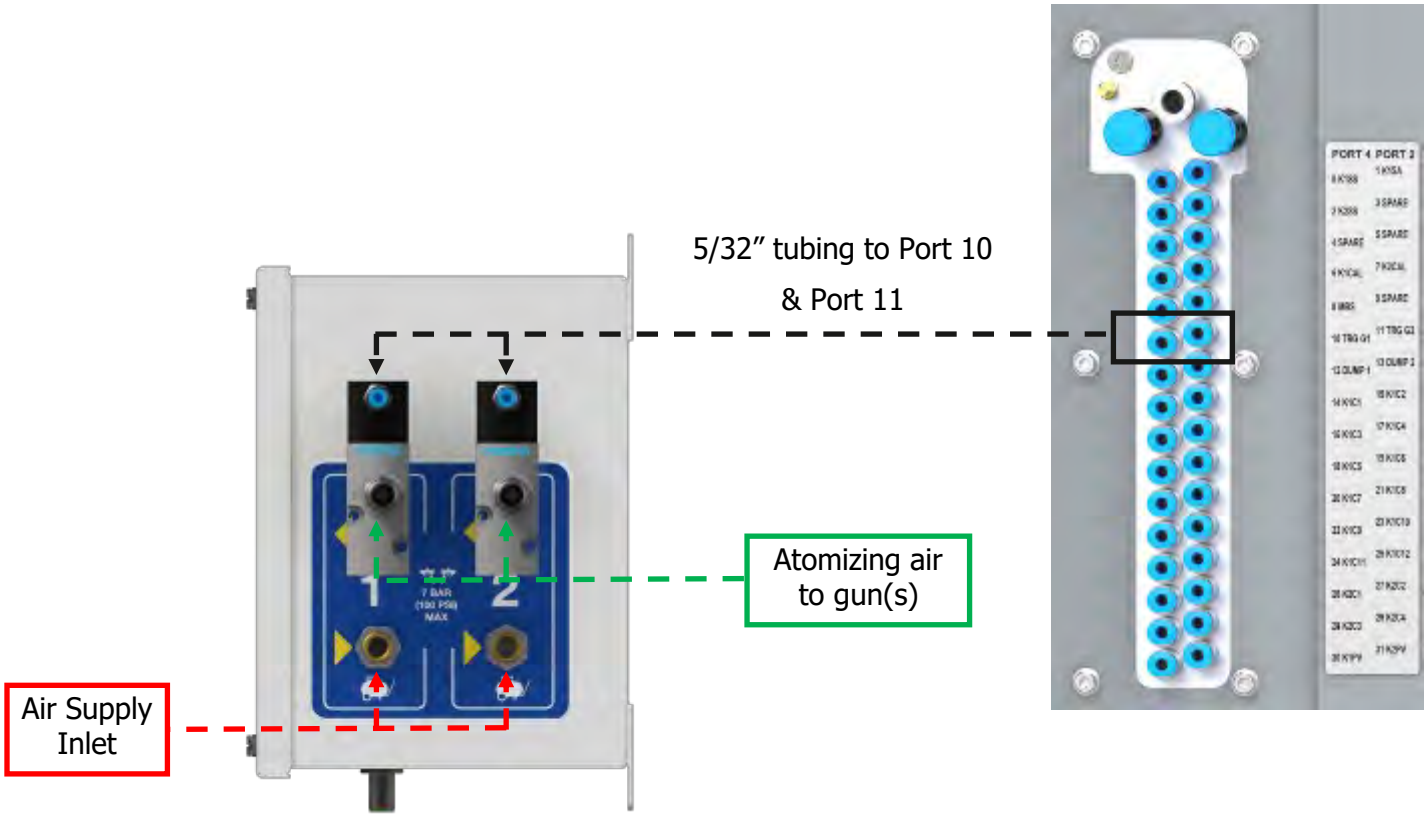


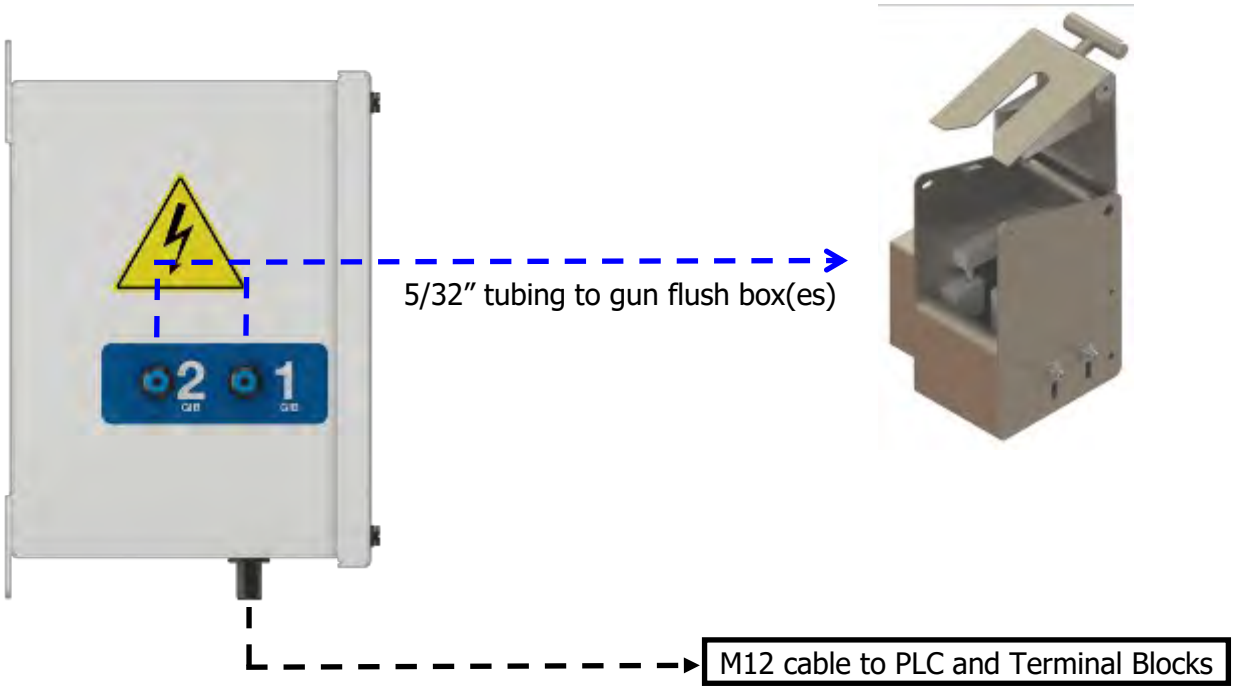




Verify the M12 cable from air cut off box to RF2 connections in the table below.

| ITEM | WIRE COLOR | SIGNAL | PLC and TERMINAL BLOCK-LANDING LOCATION |
|---|---|---|---|
| a | BROWN | 24VDC | TERMINAL BLOCK 1141 |
| b | BLUE | GUN-IN-BOX, GUN 1 | SLOT 1, PIN 4 |
| c | WHITE | GUN-IN-BOX, GUN 2 | SLOT 1, PIN 8 |
| d | GRAY | FLOW SWITCH, GUN 1 | SLOT 2, PIN 5 |
| e | BLACK | FLOW SWITCH, GUN 2 | SLOT 2, PIN 6 |

## Air Cut Off Box Connections Diagram




5/32” tubing to gun flush box(es)
M12 cable to PLC and Terminal Blocks

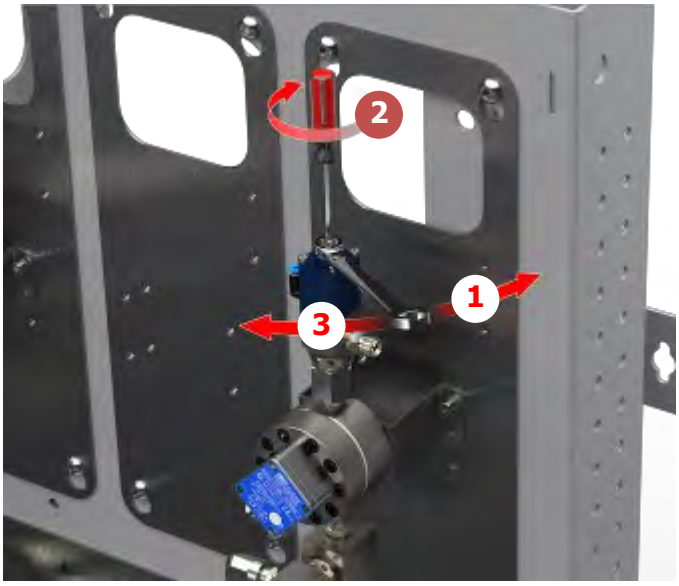
## MANUAL VALVE PULSE SETUP

### CCV Pulse Flow Adjustment-Below Range

The correct pulse flow range is in the green zone as shown between the green arrows.

In the image shown at the right, the blue diamond shape is left of the green zone and below range. The flow must be increased to a specified 50%. Follow the steps below to adjust the valve flow.


1. Use a 13 mm wrench and turn it counterclockwise to loosen the jam nut on the adjustment screw.
2. Turn the adjustment screw clockwise until the blue diamond moves to the center of the green zone range.
3. Turn the wrench clockwise to set the adjustment screw in position.

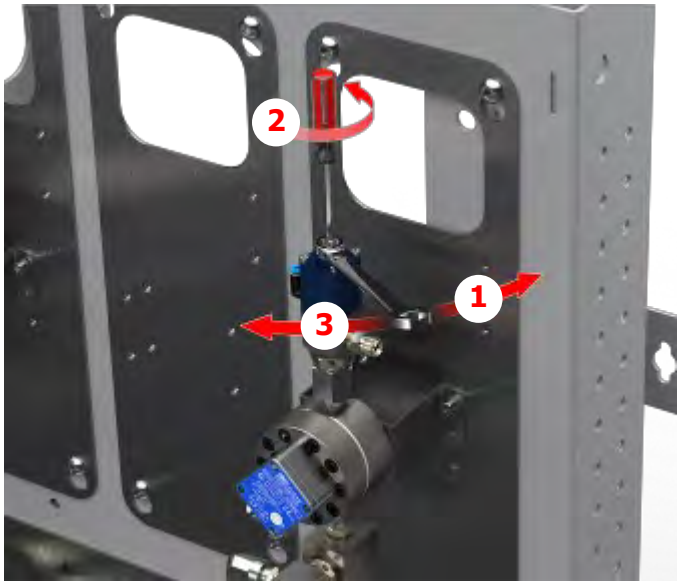


## CCV Pulse Flow Adjustment-Above Range

The correct pulse flow range is in the green zone as shown between the green arrows.

In the image shown at the right, the blue diamond shape is right of the green zone and above range. The flow must be decreased to a specified 50%. Follow the steps below to adjust the valve flow.


1. Use a 13 mm wrench and turn it counterclockwise to loosen the jam nut on the adjustment screw.
2. Turn the adjustment screw counterclockwise until the blue diamond moves to the center of the green zone range.
3. Turn the wrench clockwise to set the adjustment screw in position.



## CCV Pulse Flow Adjustment-In Range

The correct pulse flow range is in the green zone as shown between the green arrows.

In the image shown at the right, the blue diamond shape is in the center of the green zone and is in range. This is the optimal position, and no more adjustment is necessary.

To enable pulse valve flow control, go to page 2 of 4 in the System Configuration menu (discussed on manual page 67). Select "Pulse" for Channel 2.

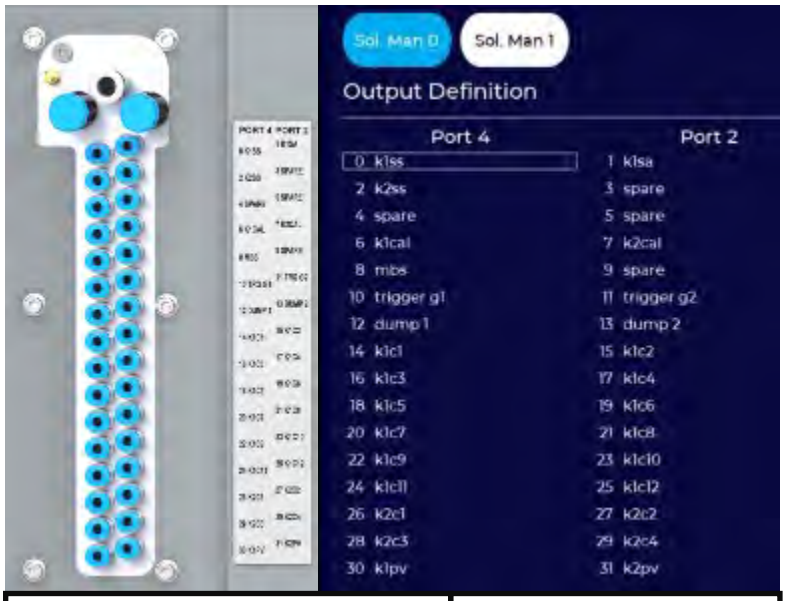
## EXTERNAL AIR CONNECTIONS

The RF2 can (and in some cases must) control air signals that are external to the RF2; these include gun trigger and dump signals. Every solenoid controlled by the RF2 is programmable, so the individual port location for any signal depends on the programmed location for that signal.

The RF2 will be pre-programmed from the factory with a standard list of signals for the purchased configuration. A list will be provided showing the air connections as programmed. It is also possible to view and modify this list as desired.


To view the list of connections:

1. Navigate to the Setup Menu -> Output Configuration (see "Running the System" section for more information).
2. Select the manifold (on the top of the output config menu) to view. Note the RF2 can control up to four solenoid manifolds, but in many cases the system will only be configured for one. Only manifolds that are present will be shown.
3. The list of outputs is shown as Port 4 and Port 2, with 16 rows represent the possible 16 modules (each having two solenoids) in the selected manifold. The orientation is the same as the view of the air connections at the base of the solenoid manifold.




All air signals that control elements that are provided with the RF2 will be pre-programmed, and their air tubing will be pre-installed if possible. But their solenoid locations may also be viewed or modified using the same procedure as above.

If a solenoid fails due to wear, or other damage, etc., a quick "output swap" process is provided so that any two outputs configurations and functionality can be swapped. This function is located in the Output Configuration section of the System Setup Menu.

Normally, the system will be provided with some unused solenoids that can be used for this purpose. Refer to the Setup section of this manual for more details.

More information about output configuration is given in "System Configuration" and "Running the System" sections.

| **CCV Output Definition Key** | **For example:** |
|---|---|
| k = Component | k1cal = Component 1 Calibration |
| # = Channel/Component # | k1c3 = Component 1 Color 3 |
| ss = Stack Solvent | k2c3 = Component 2 Color 3 |
| sa = Stack Air | k1pv = Component 1 Pulse Valve |
| c = Color | |
| pv = Pulse Valve | |
| cal = Calibration | |
| mbs = Mix Block Solvent | |

## AUXILIARY SIGNALS

The RF2 is designed to be placed inside a larger process to take commands from paint / assembly lines, robotic cells, etc. Commands and Status information can be communicated to and from the unit via discrete wiring or by fieldbus. Both methods can be used simultaneously if desired. While it is possible to fully run the RF2 system with hardwired signals, much more functionality is available through fieldbus communications.

### Hardwired I/O (Discreet Wiring)

If it is desired to use hardwired signals to give basic commands and receive basic status information, the following digital signals are available.

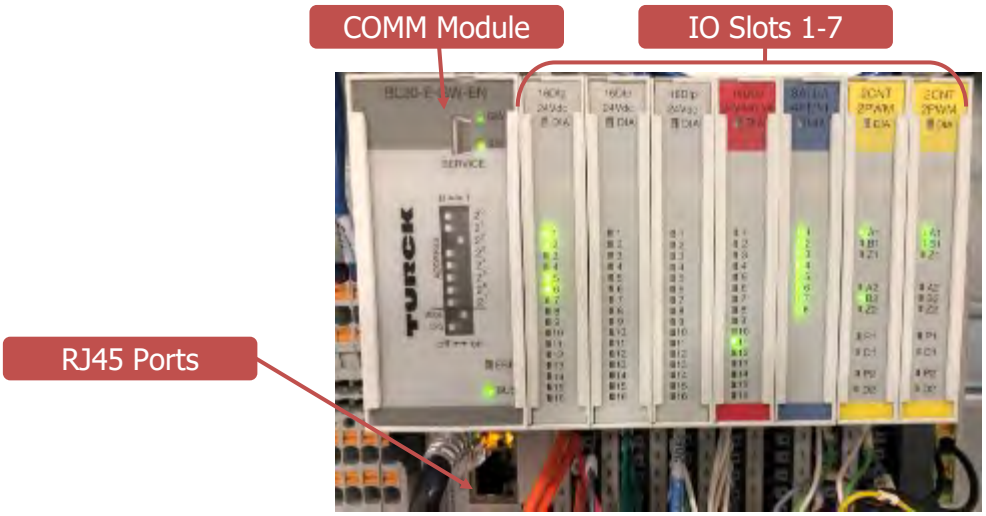
The table on the preceding pages references I/O slot and pin numbers. These correspond to the physical location of the connection. Slots being cards, numbered low to high from the left, and pin numbers being the connection from low to high from the top of a given slot.

| | SLOT 1 (DIGITAL INPUTS) |
|---|---|
| 1 | Station #1 Sequence Interlock-24V = Interlock OK |
| 2 | Station #1 Spray Interlock-24V = Interlock OK |
| 3 | Station #1 Recipe Strobe-24V Pulse loads selected Recipe |
| 4 | Auto gun = Station #1 Applicator ready; Manual Gun = Station #1 Flush box |
| 5 | Station #2 Sequence Interlock-24V = Interlock OK |
| 6 | Station #2 Spray Interlock-24V = Interlock OK |
| 7 | Station #2 Recipe Strobe-24V Pulse loads selected Recipe |
| 8 | Auto gun = Station #2 Applicator ready; Manual Gun = Station #2 Flush box |
| | **SLOT 2 (DIGITAL INPUTS)** |
| 1 | User Input #1 (For Pass-Through) |
| 2 | User Input #2 (For Pass-Through) |
| 3 | User Input #3 (For Pass-Through) |
| 4 | User Input #4 (For Pass-Through) |
| 5 | Auto Gun = Mix #1 Trigger Cmd, Manual Gun = Mix #1 Manual Trig Flow Switch |
| 6 | Auto Gun = Mix #2 Trigger Cmd, Manual Gun = Mix #2 Manual Trig Flow Switch |
| 7 | Auto Gun = Mix #3 Trigger Cmd, Manual Gun = Mix #3 Manual Trig Flow Switch |
| 8 | Auto Gun = Mix #3 Trigger Cmd, Manual Gun = Mix #4 Manual Trig Flow Switch |
| 9 | Job Data Binary 1 |
| 10 | Job Data Binary 2 |
| 11 | Job Data Binary 4 |
| 12 | Job Data Binary 8 |
| 13 | Job Data Binary 16 |
| 14 | Job Data Binary 32 |
| 15 | Job Data Binary 64 |
| 16 | Job Data Binary 128 |

| | SLOT 3 (DIGITAL INPUTS) |
|---|---|
| 3 | System Fault Reset Pulse |
| 4 | Station 1 Run Pulse |
| 5 | Station 1 Halt Pulse |
| 6 | Station 2 Run Pulse |
| 7 | Station 2 Halt Pulse |
| 8 | Reserved |
| 9 | Reserved |
| 10 | Reserved |
| 11 | Reserved |
| 12 | User Input #5 (For Pass-Through) |
| 13 | User Input #6 (For Pass-Through) |
| 14 | User Input #7 (For Pass-Through) |
| 15 | User Input #8 (For Pass-Through) |
| 16 | User Input #9 (For Pass-Through) |
| | **SLOT 4 (DIGITAL OUTPUTS)** |
| 1 | Station #1 HV Enable |
| 2 | Station #2 HV Enable |
| 6 | Station #1 Run Mode |
| 7 | Station #2 Run Mode |
| 13 | Gun/Mix #1 Pot Life Expired |
| 14 | Gun/Mix #2 Pot Life Expired |
| 15 | Gun/Mix #3 Pot Life Expired |
| 16 | Gun/Mix #4 Pot Life Expired |
| | **SLOT 5 (ANALOG INPUTS)** |
| 1+, 2- | Programmable Analog Input #1 |
| 3+, 4- | Programmable Analog Input #2 |
| 5+, 6- | Programmable Analog Input #3 |
| 7+, 8- | Programmable Analog Input #4 |
| 9+, 10- | Programmable Analog Input #5 |
| 11+, 12- | Programmable Analog Input #6 |
| 13+, 14- | Programmable Analog Input #7 |
| 15+, 16- | Programmable Analog Input #8 |
| | **SLOT 6 (HIGH-SPEED COUNTER)** |
| 1-5 | Channel #1 Flow Meter |
| 6-10 | Channel #2 Flow Meter |
| | **SLOT 7 (HIGH-SPEED COUNTER)** |
| 1-5 | Channel #3 Flow Meter |
| 6-10 | Channel #4 Flow Meter |

## Analog hardwired inputs

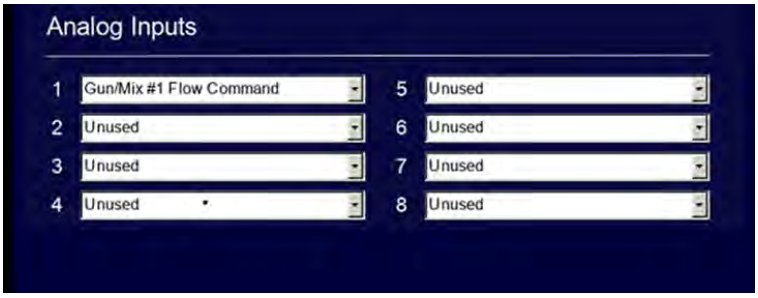
Additionally, the RF2 has eight analog inputs, which can be configured for various system functions, including flow command for a gun or mixer.




The analog input module used by the RF2 will be pre-configured for eight 2-wire 4/20mA signals, but each channel can also be configured as a 0-10V, 1-5V, etc. input type. Changing the configuration of the input itself requires the user to access the onboard webpage for the Turck I/O module. Only qualified personnel should perform this procedure.

Assignment of an analog input to a given function is done through the following procedure:

1. Log in as an administrator.
2. Navigate to Setup -> System Configuration.
3. Press "Next" until reaching the fourth page, which contains the assignments for analog inputs.
4. Assign each analog input as desired. See screenshot to the right.
5. Press "Finish" to store the configuration—the system will reboot.



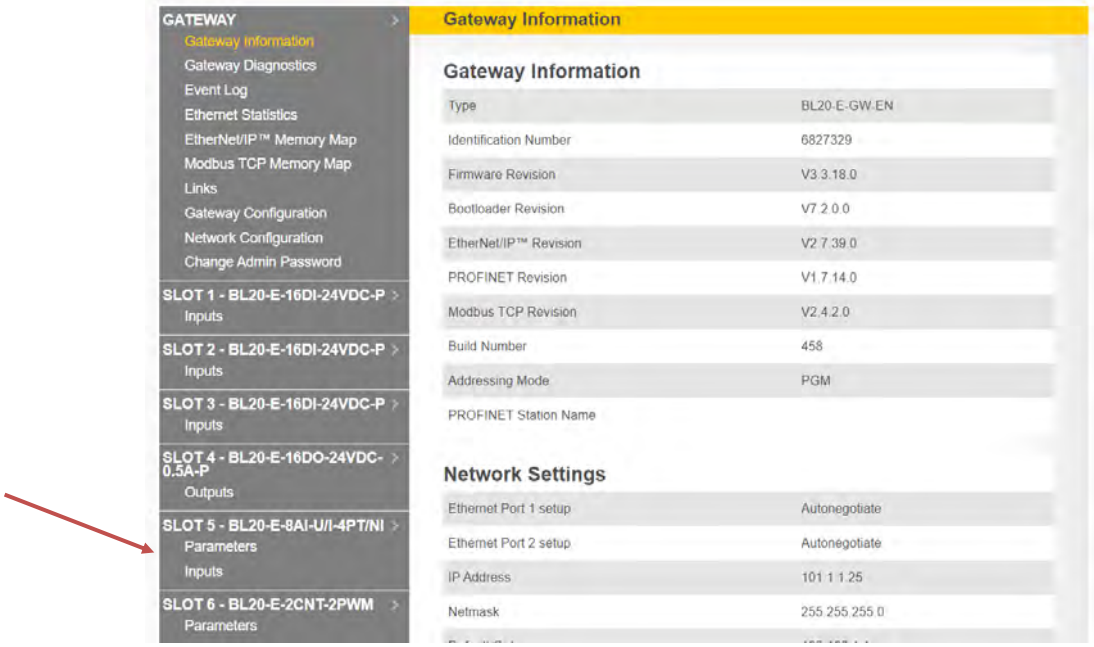

Analog Types available are:

- Inlet Pressure (Channel 1 to Channel 4)–used by gear-pump (future addition) channels to read inlet pressure.
- Outlet Pressure (Channel 1 to Channel 4)–used by gear-pump (future addition) channels to read outlet pressure.
- Flow Command (Gun/Mix 1 to 4)–used as the overall flow command for the indicated gun or mixer.
- Flow Feedback (Channel 1 to 4)–analog flow feedback sensor if used instead of a pulsing sensor (future addition)
- Solvent Flow Meter (Station 1 or 2)–used as a solvent flow meter for verification of a flush, etc.

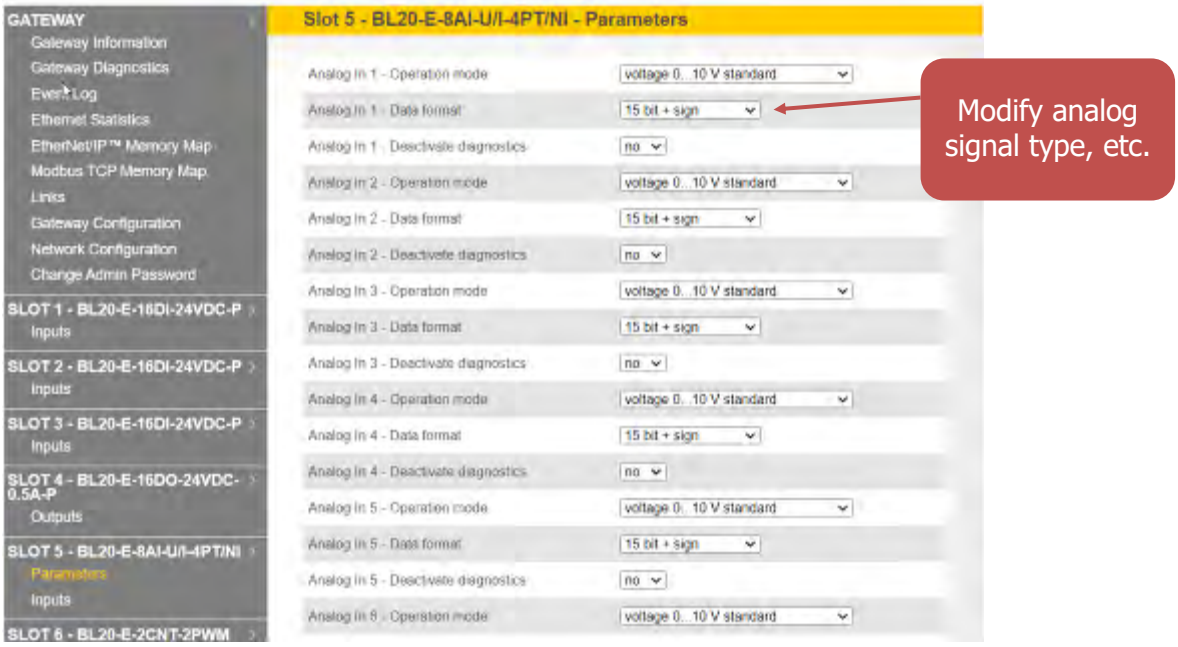
Wiring for the analog signals is done on slot 5, pins (1+, 2- for input 1, 3+, 4- for input 2...). See schematics for more details.

To modify the type of analog input:

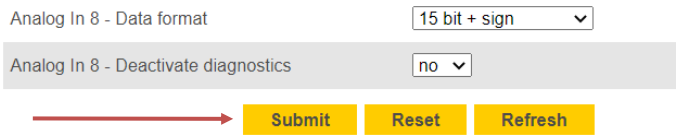
1. Connect a laptop to the open RJ45 port on the Turck I/O Block.
2. Set the laptop IP address to 101.1.1.99
3. Open a web browser, such as Google Chrome, and type 101.1.1.25 in the URL.
4. Log in with the password = "password".
5. Select the analog input module: Slot 5 – BL20-E-8AI-U/I-4PT/NI




6. Modify the channels as necessary. Consult Turck BL20 IO manual for more details.



7. Press the "Submit" button.




**NOTE**

For analog current inputs, both 2-wire and 4-wire styles are possible, but note that if using 4-wire channels, it eliminates another input channel, reducing the number of inputs available. It is recommended to use only two wire current inputs or voltage inputs with the RF2.

## Fieldbus Communications: Ethernet

The RF2 can communicate via fieldbus through its RJ-45 plant ethernet connector.

The RF2 uses Ethernet / IP communications protocol in its most basic configuration. The plant or supervisory PLC can utilize CIP Data Transfer Read or Write commands via a Message instruction (MSG - Rockwell) or equivalent to get status information or give commands.

If desired, the RF2 can be configured to use a gateway module that establishes an implicit communications path between the RF2 and some other industrial protocol, such as ProfiNet, Modbus TCP, CC-Link, etc.

Sample codes are available from Carlisle Fluid Technologies. They can be imported into the supervisory PLC to facilitate communications more quickly with the RF2 and provide data structures for the communicated information.

Signal lists and more detailed information to establish communications with the RF2 are given at the end of this manual.

## Fieldbus Communications IP Address Setting (without gateway)

Series 1 RF2 control units use an Allen Bradley–Compact Logix PLC with two separate ethernet networks as the primary controller. Network A1 is used for local communications to RF2 devices such as I/O and solenoid manifolds. Network A2 is used for communications to a plant.

To prepare the RF2 control:

1. Plug an RJ-45 ethernet cable into an open port on a local ethernet switch (ESW128).
2. Set the Allen Bradley PLC to "PROG" mode.

To set the IP address, download RSLinx Classic software from Rockwell Automation (found online). There is a free version (Lite) available. **RSLinx Classic version 4.30 or higher must be used.**

Use the following procedure for setting the IP address for Network A2 on Series 1 RF2 units:

1. Set the IP address of the user's laptop or PC to 101.1.1.99, subnet Mask 255.255.255.0
2. Open RSLinx software.
3. Select Communications - > "RSWho."
4. Select the ethernet IP driver and scan the network (Most likely this will be named AB_ETHIP1). Refer to the configuration note* if the protocol is not present.
5. Find the RF2 controller at IP address 101.1.1.20–right click and select module configuration.
6. Select "Port Configuration Tab."
7. Select Network A2.
   **WARNING: Do not modify anything in Network A1. The system can be rendered inoperable.**
8. Set the IP address as desired to communicate to the Plant controller and click "OK."
9. With these steps completed, set the PLC/IP address back to Run or remote mode.

---

***Configuration note:** If RSLinx is not configured to have an ethernet IP driver, do the following:

A. Select Communications -> "Configure Driver."
B. In the "Available Driver Types" pulldown, select Ethernet/IP Driver, click "Add New."
C. Click "OK"–the new driver will be added.

---

## Fieldbus Communications IP Address Setting (with gateway)

When the AnyBus communications gateway is installed in the system, the RF2 will already be configured to communicate with it. The gateway itself must be configured on the plant side to talk to the plant.

To configure the plant side of the gateway, download and install HMS IPconfig Software from:
www.AnyBus.com/support

Connect the PC with HMS IPconfig software loaded to the plant side network ports of the gateway device. Set the IP address of the laptop to the network that you wish to place the gateway on. Start HMS IPconfig software.

When HMS IPconfig is started it will automatically scan for compatible and active HMS devices. To change the IP configuration for a device, click on the device in the list.

Pressing "refresh" in the IPconfig software will cause the software to rescan the network. When selecting a device, pressing the "wink" button will cause the device LEDs to flash, verifying that the correct device has been chosen.

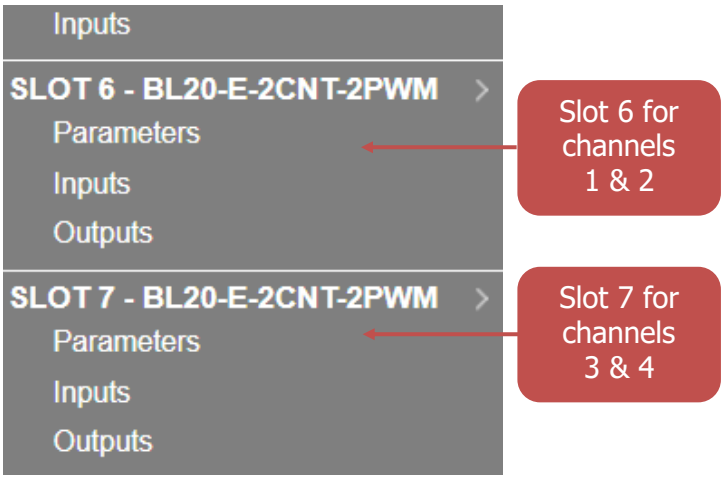
IP and DNS settings can be configured manually or dynamically using DHCP by modifying them in the right hand section of the page and pressing apply See the User Manual for HMS IPconfig software for more detailed information.

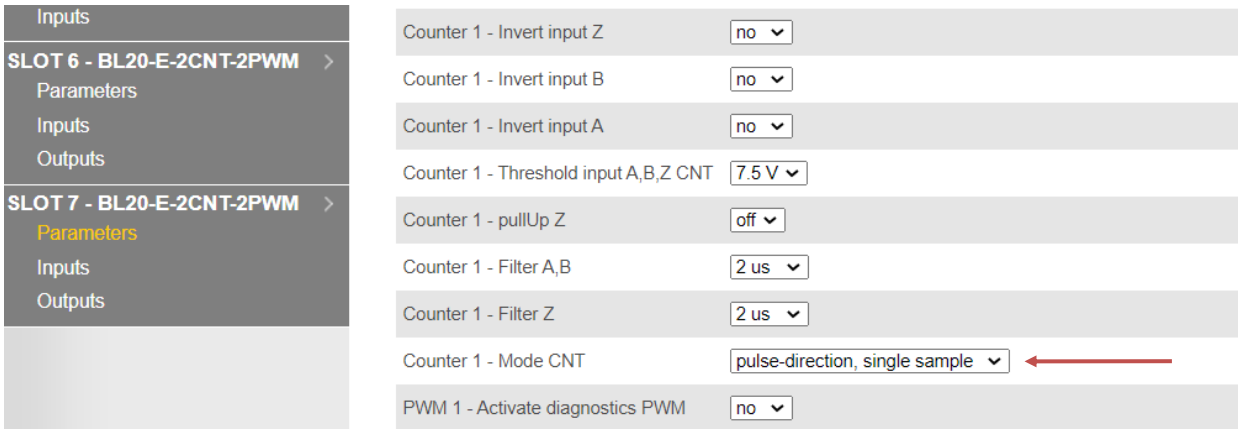
## Configure High-Speed Counter I/O (non-quadrature flow meters)

In some installations, the standard flow meter may not be used. Some pulsing flow meters do not have quadrature output.

If this is the case, the channel must be modified in order to accept a single pulse input. To do this:

1. Connect a laptop PC to the open RJ45 connector on the Turck I/O block. Set the laptop IP address to 101.1.1.99
2. Using a web browser, enter 101.1.1.25 into the URL.
3. In the Login field, enter "password".
4. Click "Parameters" for the slot you wish to modify. Channels 1 and 2 are connected to slot 6, channels 3 and 4 are connected to slot 7.
5. Find Counter 1 or Counter 2–Mode CNT. Counter 1 will be for the first channel connected to the slot, Counter 2 is for the second–for example Slot 7, Counter 1 is for channel 3.
6. The default setting for this field is "AB Mode–4 samples", for a single pulse–change this to "pulse-direction, single sample."
7. Click "Submit." The counter is now configured.




**NOTE**

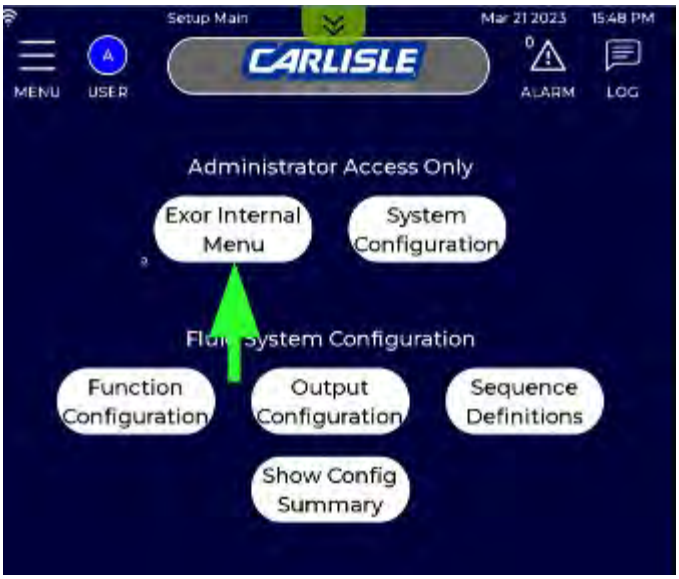
In this mode, for the count direction to be positive, the D2 pin for the channel (pin 2 or 7) must be connected to 24VDC. If the flow meter has directional output, this can be used for direction; otherwise, connect a 24V jumper to the direction pin.

## DISPOSAL INFORMATION

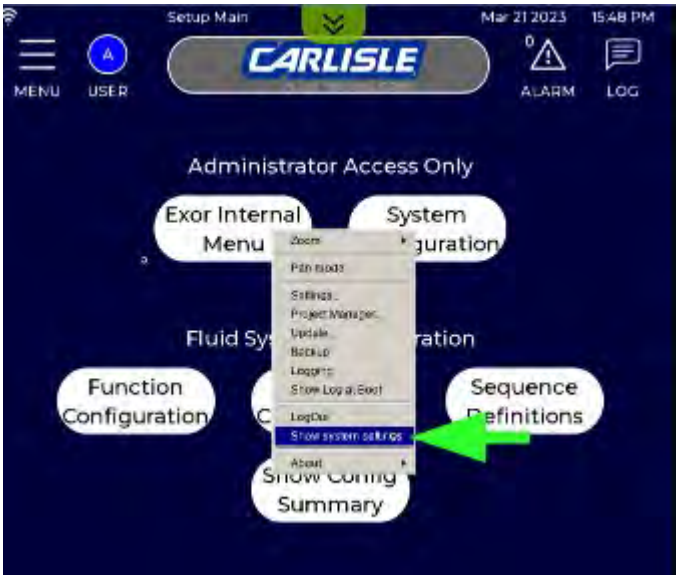
Prior to disposal of this equipment at the end of it's life cycle, all components containing electronic printed circuit boards (PCBs), sensors, and any wetted parts that may contain hazardous materials should be separated from the unit and recycled/disposed of according to local regulations.

## RF2 CLOUD SETUP

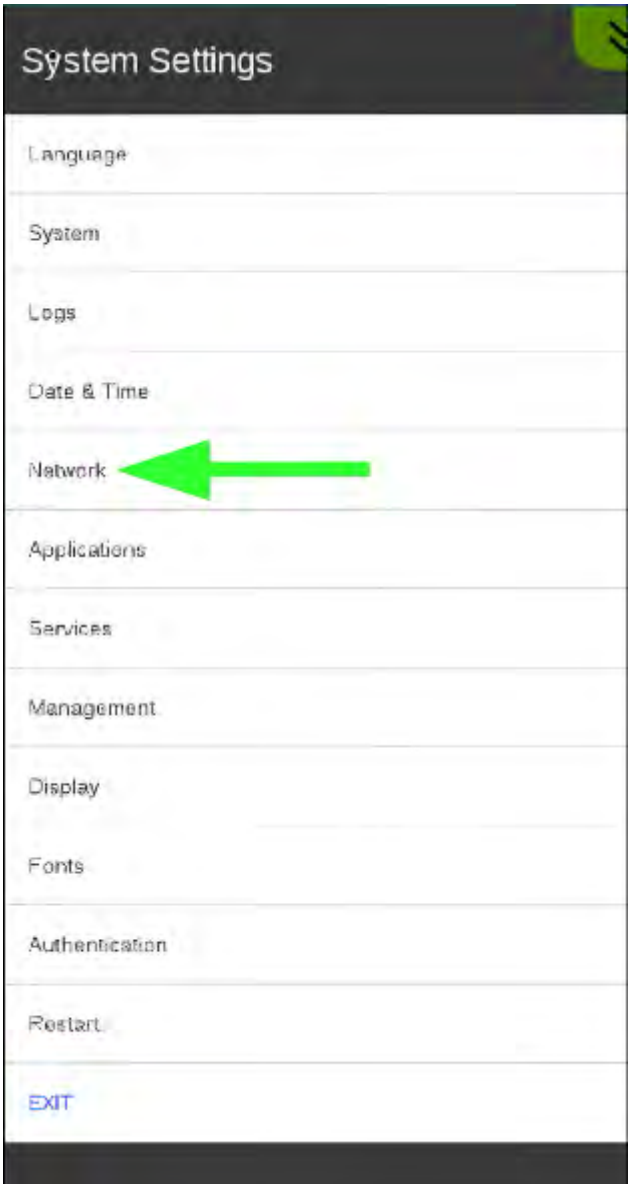
1. Login to 'admin' user.
2. Select Menu > Setup > Exor Internal Menu.




3. Select > Show system settings.



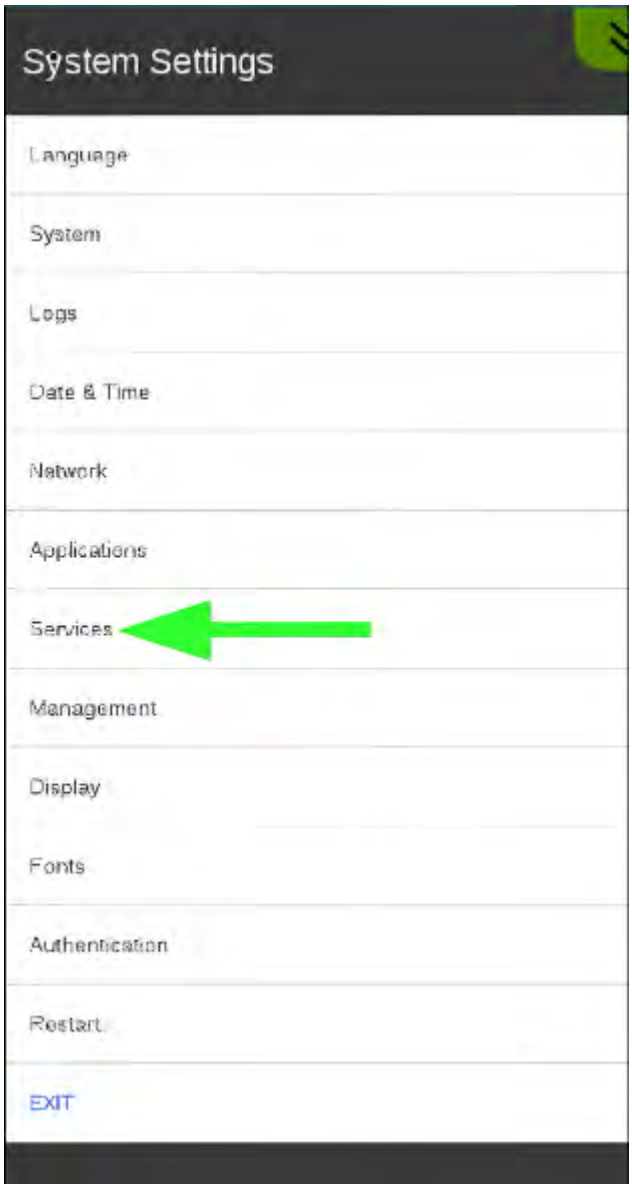
4. Select "Network."




5. Select "Edit."

6. Enter Network and network password. Click "Save."


7. Click "Menu" at the top left. Select "Services."



8. Enable these three (3) services:
   a) VNC Service,
   b) Router/NAT/Port Forwarding
   c) Cloud/VPN Service


9. In "Cloud/VPN" verify the following settings:
   Server: us.corvinacloud.com
   Username: RF2-machineserialnumber/organization
   Example: RF2-1234/CFTLiquid
   Password: paint123$

# OPERATION

## POWERING UP THE SYSTEM

Before system start-up, make sure the main power has been correctly installed. See the section on electric installation for more details.

To start-up:

1. On the right hand side of the control module enclosure, turn the rotary disconnect switch clockwise. The system will go through a boot-up sequence. When ready, a button will show on the screen to access the "Main Menu."
2. On the start-up menu, along the bottom, change the language of the display by pressing the "flag" icons for the appropriate country/language.
3. On the bottom-right-hand side of the start-up menu, press the "config summary" button to access the configuration summary page–which briefly describes how the system hardware has been configured.
4. Pressing the Main Menu button will:
    a. Open the main "Run" menu if the system has been configured and the user-preference to "show configuration summary on startup" is not set.
    b. Open the "Configuration Summary Menu" if the system has been configured and the user-preference to "show configuration summary on startup" is set.

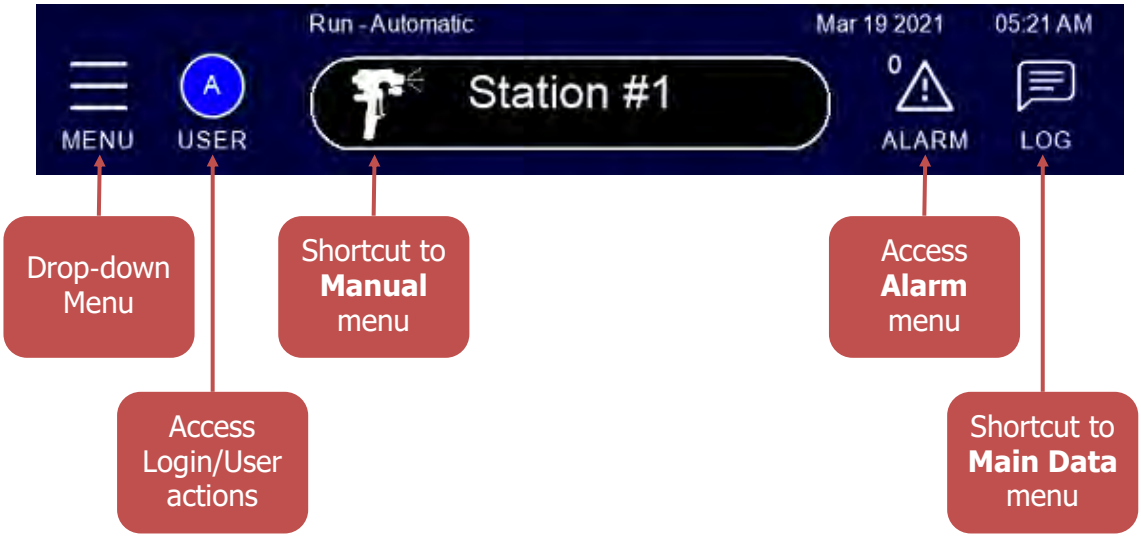
**NOTE**

If the system is not configured, refer to the configuration section of this manual to proceed.

    c. Open the "System Configuration Menu" if the system is not configured.

## NAVIGATION BAR

Except on certain menus that have special purposes, the navigation bar shown below will be visible in the upper section of the screen. Each section will be discussed separately in this manual.



Press the "Menu" button to open a drop-down menu to access other menus.

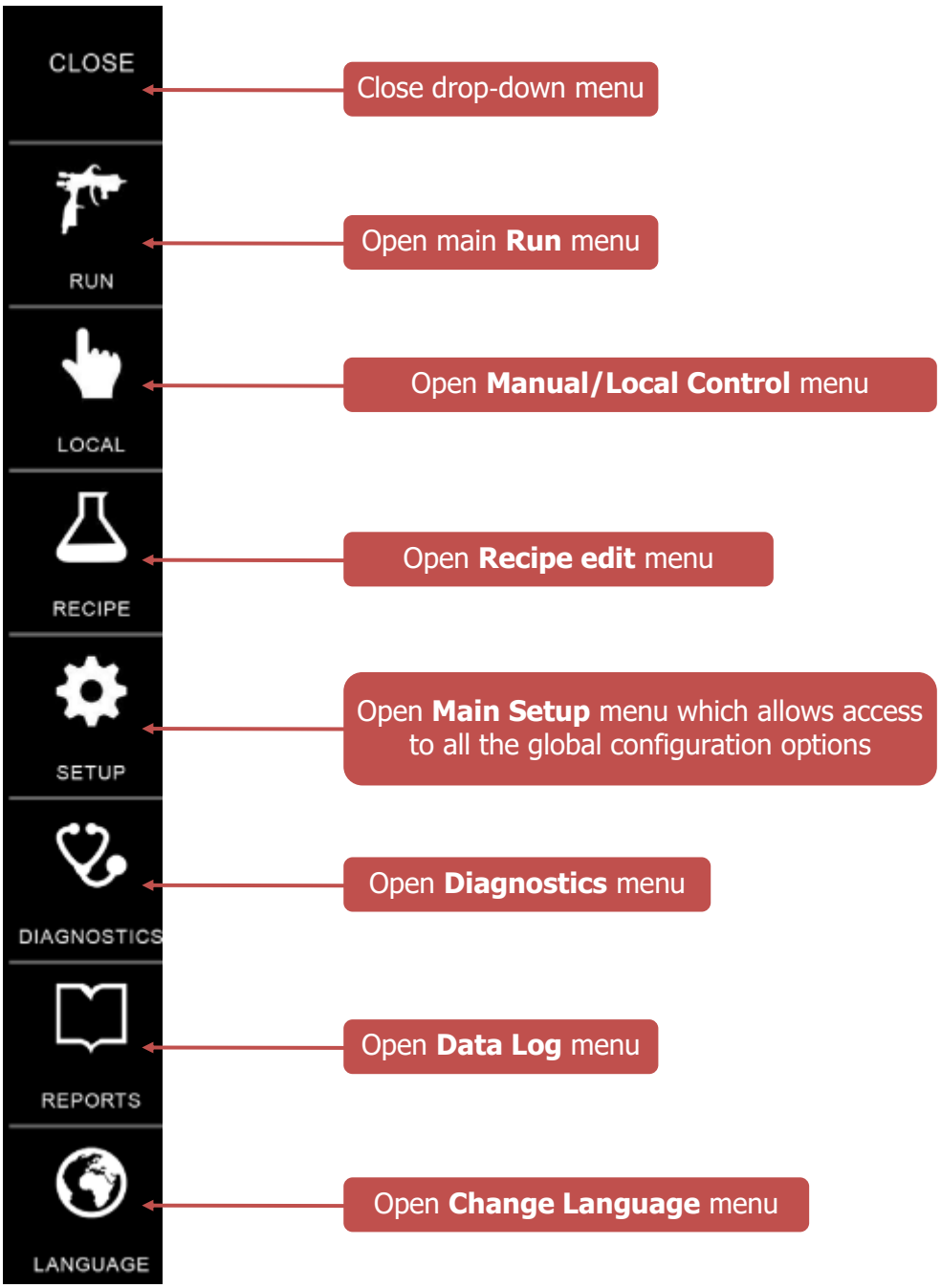
Press "User" to open a dialog menu to log-in, log-out, and access other functionality available to the administrator.

Press "Alarm" to open the alarm status/history menu.

Press "Log" to open the main data-logging menu.

## Drop-Down Menu

Available options on the drop-down menu are shown below. Access to specific functions is limited by the administrator for designated users.



## LANGUAGE SETTINGS

System Languages can be chosen by selecting the "Language" icon (a) at the bottom of the menu drop down, and selecting the user's language from the list (b) to the right.

**NOTE**

Some objects are not part of this run-time project. These include, for example, user-editable fields: station, gun, channel, and output names, as well as some menus like Exor's internal HMI menus. These cannot be translated in run-time and will remain the same regardless of the selected user's language.

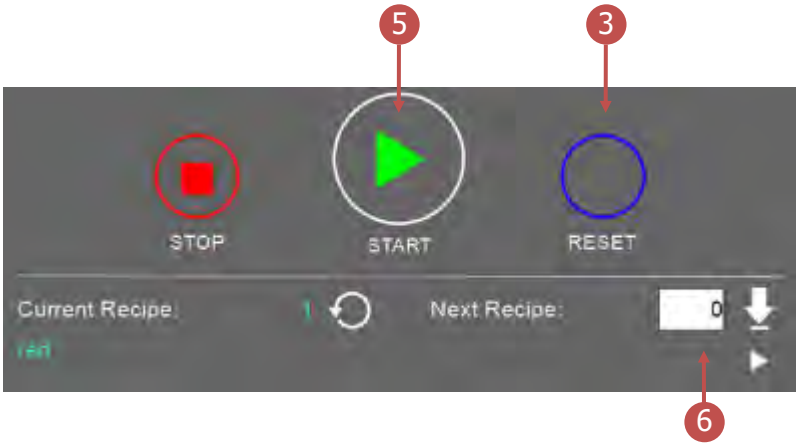

## RUNNING THE SYSTEM

### Loading Recipes

For each station, up to 250 user recipes may be stored. It is recommended that each material being used will have a dedicated recipe. Recipes may be loaded from the operator interface of the RF2, or through commands from a supervisory control process.

To load a recipe from the operator interface, perform the following steps in order:

1. Navigate to the "Run" menu using the drop-down menu.
2. Make sure all faults are reset.
3. The "Run" menu will show a brief list of active alarms if any exist. If not, press the "Reset" button to clear any alarms, or try further troubleshooting as necessary.
4. If the RF2 has been configured for two stations, select the applicable station.
5. Press the "Start" button to place the station in run-state. The text will change to show "Running."
6. Select the appropriate recipes from the dialog.
7. Press the "Load" button to start the load sequence.




When the load sequence starts, the station will determine if a flush is needed before it runs the load sequence. Then it runs the appropriate sequences to load material. When this happens, the bottom of the Run menu will show the load sequence. All Start/Stop/Reset and recipe-select functionality will be unavailable during this time.

When the load sequence is complete, the material is loaded, and the station is in run-state, the system will respond to trigger and flow commands for any configured Guns/Mixers for the station and control.

## Editing Recipes

Select "Recipe" from the drop-down menu to view or change recipe parameters.

The "Materials" section of the recipe menus will open. At the top of this other recipe menus, "Mix/Guns" will be available if configured in the selected station or greyed out if they are not configured.

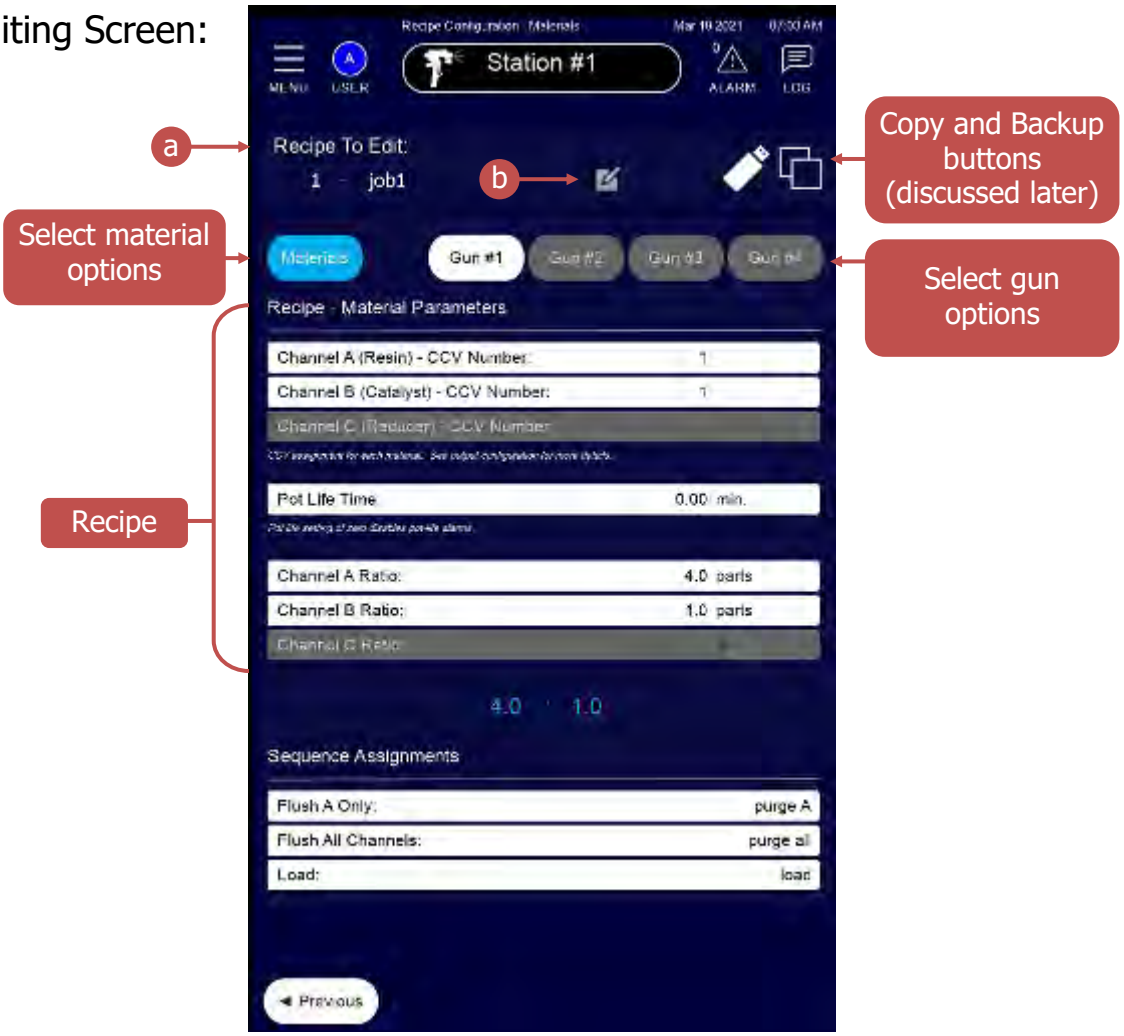
Access to channel-recipe data is located at the bottom of the "Mix/Gun" recipe menus. It will be available based on the number of channels configured for the selected Gun/Mixer. Channel A, B, or C will navigate to the settings page for the physical channels 1-4, but depends on which channel is configured for each Gun/ Mix channel.

To select a recipe to change, press the field that shows the "Recipe to Edit" (a). It will open a pop-up dialog to show selections from the list of recipes. Use the arrow buttons to scroll through the list. There are 250 recipes available per station.

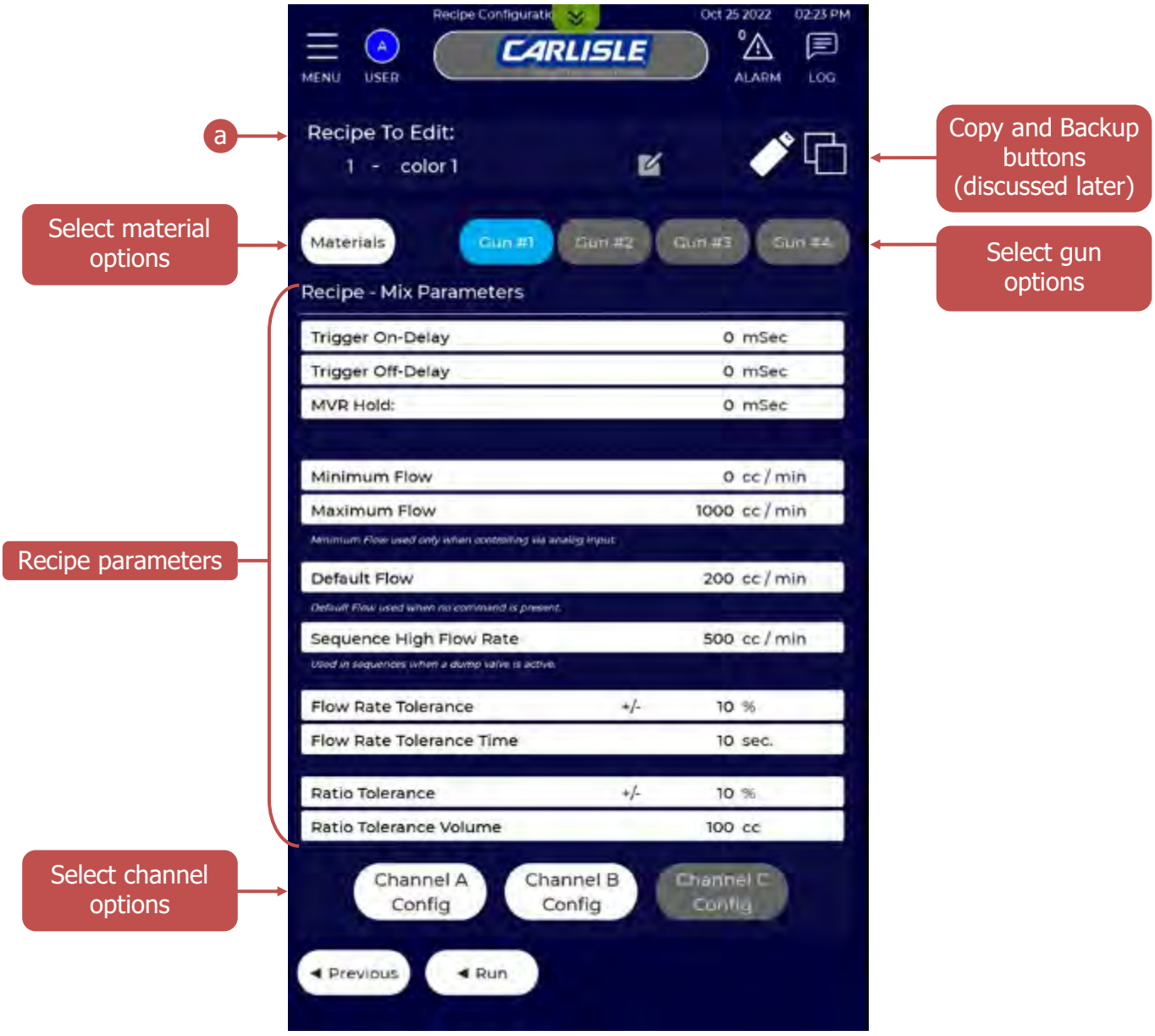
To change the selected recipe's description, press the "Write" (b) icon next to the current recipe description to open the dialog.

Screens will show differently when the materials, guns/mixers, or channels within a recipe are changed.

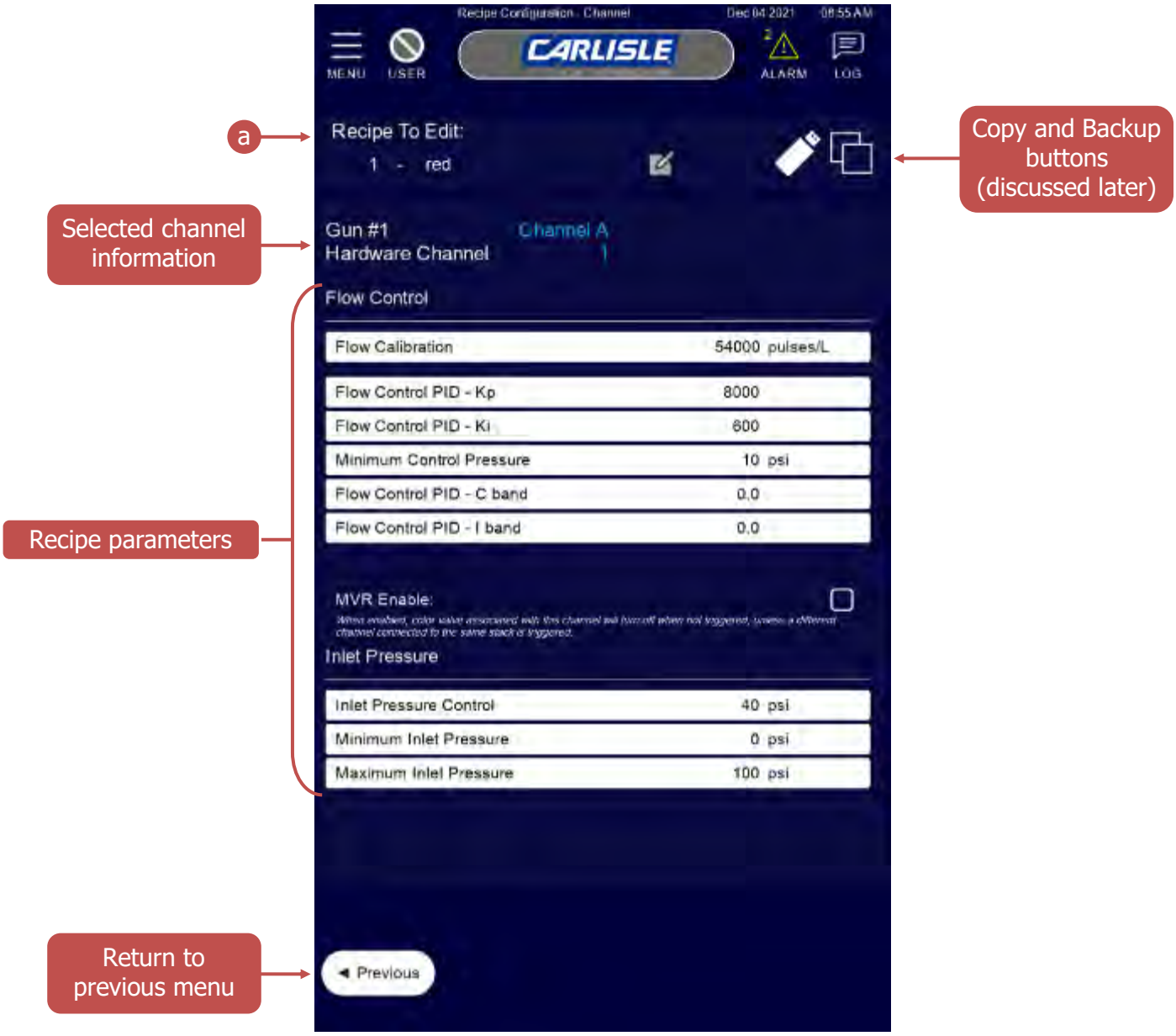
## Material Editing Screen:



# Gun/Mixer Editing Screen



## Channel Editing Screen




**NOTE**

Access to the calibration settings for the flow meter opens the calibration dialog and lets the calibration process occur.

## Copying Recipes

Press the "Copy" icon near the top of the recipe edit menu to open the copy dialog. From this menu, choose the "Source" recipe and the destination locations (1-250) that represent the available 250 recipe data registers in the selected channel. Multiple destinations can be chosen at the same time but can cause longer process times.

When the source and destination fields are set, press the "Copy" button to make a copy of all data from the source recipe to each destination location in the range. Make sure to add a "#" to each description.

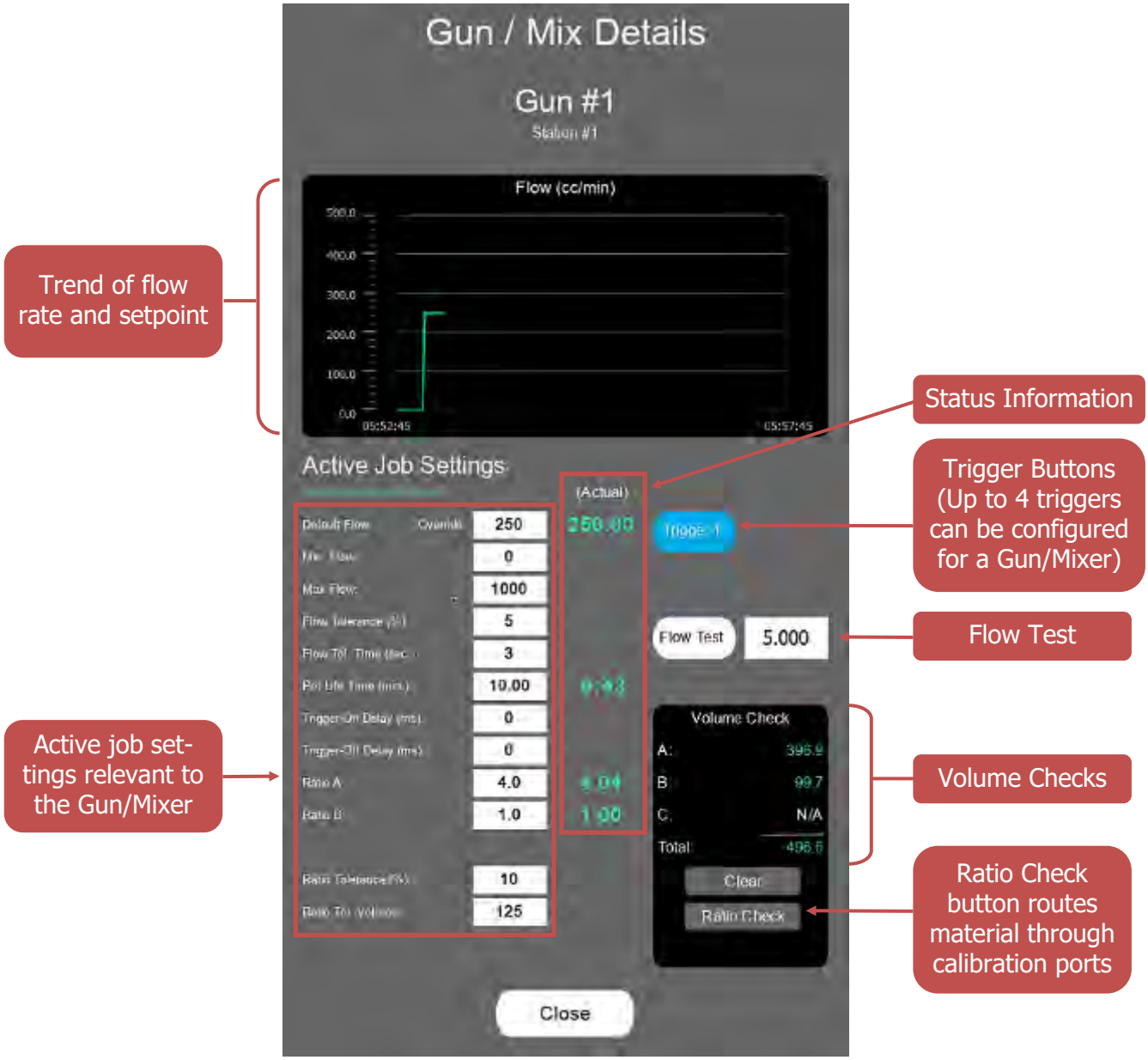
## Operate the System (manually or locally)

Though the RF2 will most commonly be put into a process that receives automatic commands, such as trigger, flow rates, and load recipes/materials, it can also be operated from the local interface.

To operate the RF2 from the main panel after the material has been loaded:

1. Navigate to the Run Menu.
2. Select the station you wish to control if the RF2 is configured as a multi-station controller.
3. Press the "Gun/Mix" panel for the unit you wish to control. A popup dialog box will show the details of the selected gun or mixer.

4. If the logged-in user has permission, the active setpoints from the selected recipe will be editable. If not then the settings will be in view-only mode.




Note: One of these positions is the default flow rate for the recipe. If operated from the interface, it is recommended to press the override button to let this position take precedence over auxiliary positions. Those auxiliary positions can come to the RF2 from a discrete analog signal or via a fieldbus command. The active flow rate command is shown to the right of the default flow setpoint.

5. On the right side of the panels are "Trigger" buttons that start the applicators assigned to the gun/mixer. Press the trigger button to toggle the trigger between active and inactive. If multiple triggers are on during the same time, the flow rate for the gun/mixer will be the command multiplied by the number of triggers currently on.
6. When the "Flow Test" button is pressed, it can start and set "Trigger 1" for a given period.
7. The status information for the gun/mixer is shown throughout the display.

**NOTE**

Only assigned triggers to the gun/mixer will be visible on this menu.
In most cases only one will be configured.

The volume check shows the run totals for all materials in cc or mL. Press the "Clear" button to reset the totals when not triggered.

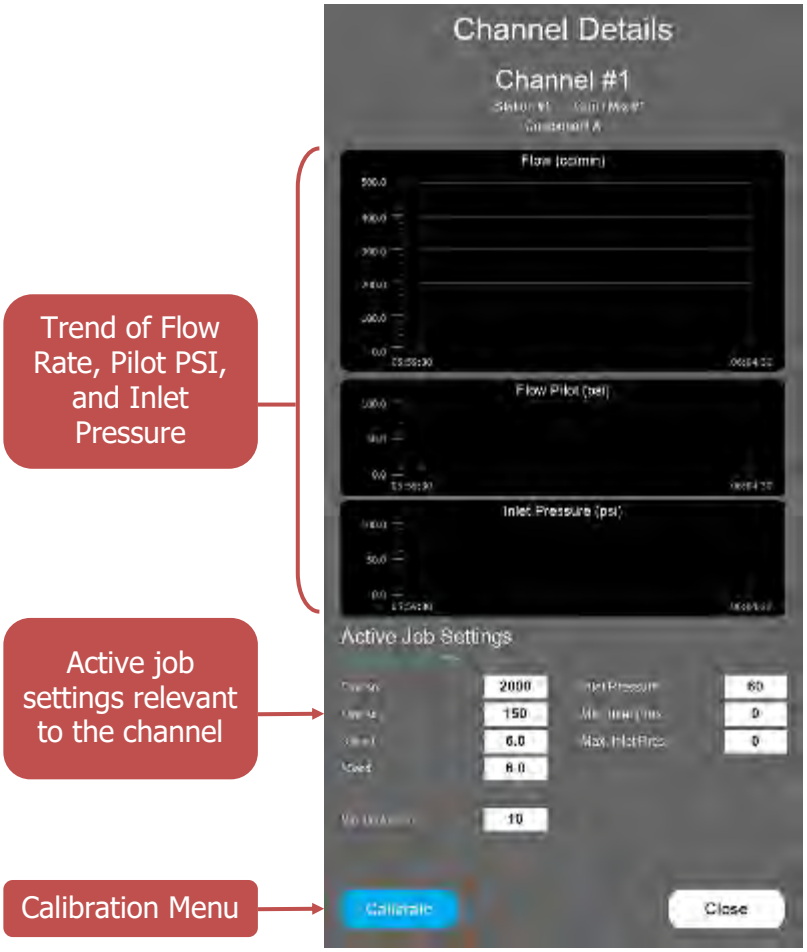
The "Ratio Check" button will cause the material to be moved from the gun trigger to the calibration test ports for all configured materials. It lets the user position beakers under the ports to catch the material, do a quick flow check on all materials, and compare them to the calculated volumes.

## Channel Menu

From the Run Menu, press any of the "Channel" panels shown to open a pop-up dialog with status and active settings for that channel.

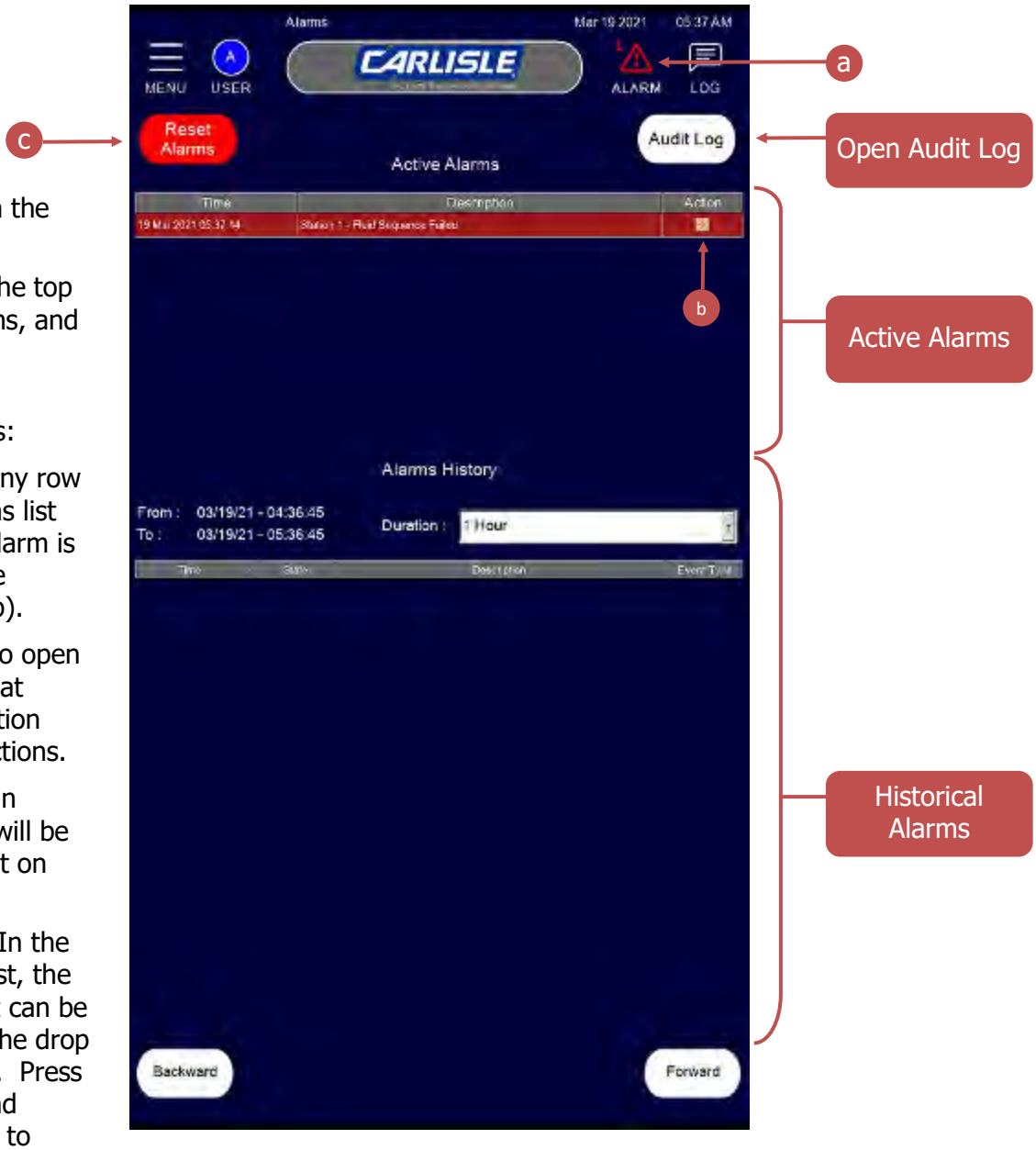
If the user has permission, they can change the active recipe parameters. Without permission, the values will be view-only.

Status information is shown throughout the display.



## Alarms Menu

On the main navigation bar, the alarm icon (a) will change color and show an alarm count if an alarm exists.




Press the icon to open the following menu.

On the Alarm menu, the top list shows active alarms, and the bottom list shows historical alarms.

For more alarm details:

1. The right side of any row in the active alarms list that contains an alarm is a button under the "Action" column (b).
2. Press this button to open a pop-up dialog that explains the condition and gives some actions.
3. Active Alarms: If an alarm is active, it will be listed in the top list on the Alarm Menu.
4. Historical Alarms: In the historical alarms list, the duration of the list can be selected through the drop -down combo box. Press the "Backward" and "Forward" buttons to scroll up and down through the list.

To reset an active alarm:

1. Press "Reset Alarms" (c) above and to the left of the active alarms list, or press "Reset" on the Run Menu. If the alarm condition has been cleared, the alarm will clear from the list and be shown only in the historical alarm list.

2. In the alarm detail pop-up menu, press "Close" (d) to exit the menu, "Condition" (e) to see the list of conditions that may cause the indicated alarm, and "Action" (f) to see a list of potential corrective actions.


## Audit Log

On the top-right of the Alarm menu, the "Audit Log" button will open a menu and show the events that have been captured by the system.

The audit log menu can be filtered (g) by user, and duration.

# CALIBRATION

## Flow Meter Calibration

Calibration of the flow meter is recommended for each individual material that is run. This is because materials of different viscosities may cause the gears within a flow meter to turn more or less than others.

Further, at low flow rates (less than 100 cc/min) flow meter operation can depend on the flow rate. Therefore, it is also recommended to calibrate material at close to the nominal flow rate for the process.

Calibration data is stored in recipe data. The calibration menu may be accessed from the recipe-edit menu or from the channel detail pop-up menu, accessed from the Run menu.

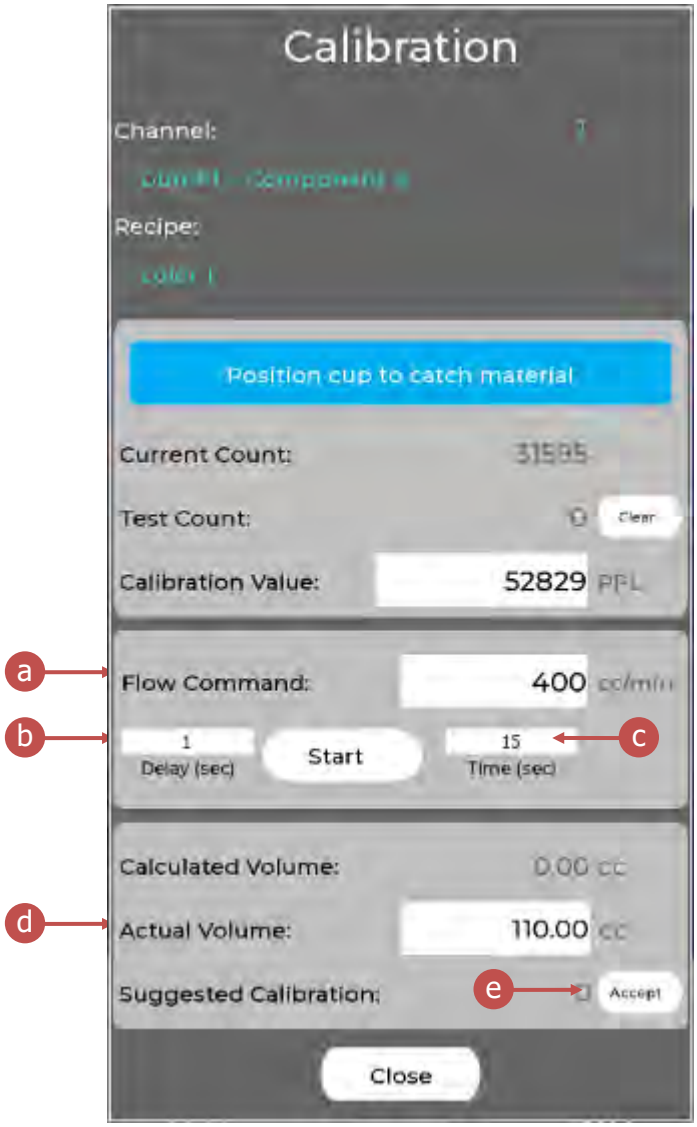
To calibrate a square wave flow meter:

1. Load a recipe/material into the system.
2. Access the calibration menu, by going through the channel detail popup, or through the recipe edit screen.

**NOTE**

A different calibration dialog may open based on the flow meter type (square wave, or 4-20mA).

3. Place a cup under the calibration port for the channel being calibrated.
4. Set a flow pilot command (a)–this will be the command given to the flow-control device during the calibration process. 100-200 cc/min is the recommended start number.
5. Set a delay time (b) (if desired) and a trigger time (c).
6. Press Start. The delay time will occur (in case this time is needed to position the beaker under the calibration port), then the calibration port will open for the set amount of time. The volume of material will be calculated (based on current calibration settings).
7. When complete, enter the measured amount of material into the "Actual Volume" field (d). A suggested calibration will be calculated based on the amount of flow-meter pulses that were counted, and the actual volume entered.
8. Press "Accept" (e) to accept the suggested calibration as the Calibration Value.




Alternatively, the calibration value can be directly entered from this menu if desired.

Changes made to the calibration are stored to the recipe parameters for the recipe loaded.

## MANUAL OVERRIDE/LOCAL FLUID CONTROL

The manual-override menu can be accessed from the main dropdown menu or when the mode icon button (a) at the top of the menu bar is pressed. This function is not available from every menu.

The Local Fluid Control menu (shown below) lets individual functions and outputs operate for maintenance and troubleshooting purposes.


To operate functions manually, press the "Manual Override" (b) button. The button will turn yellow and the icon at the top of the menu (c) will change states to indicate manual override is active.

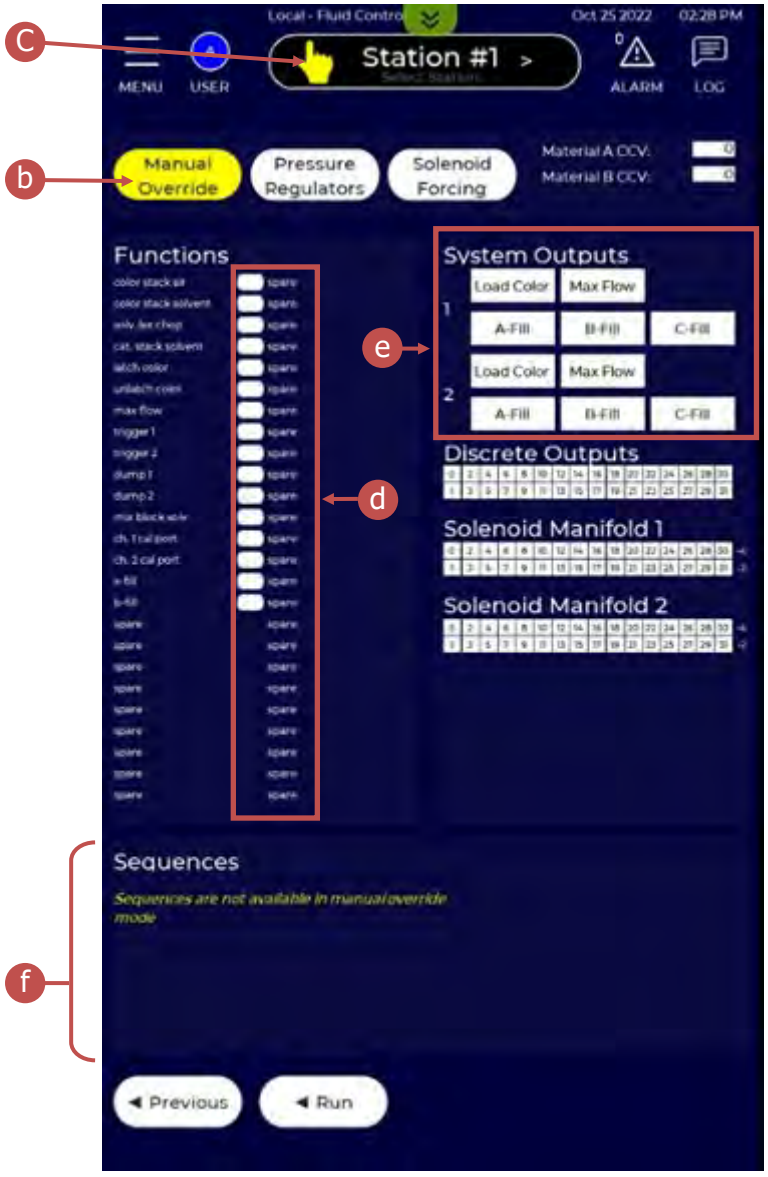
Press the button (d) to the right of any listed function and its corresponding output will activate as if the function is activated in sequence. The output status is shown to the right of the page (e).

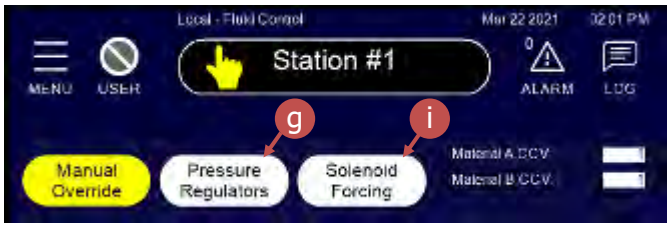
**NOTE**

Output interlocks that have been configured will continue to work in this mode. It is not possible to turn on two incompatible solenoids at one time from this menu.

When the manual override is active, material A, B, and C color valves (CCVs) can be selected. When a function activates that lets the "load color" system output to be active, the selected material valves will activate. When "load color" is unlatched, it will shut all color valves off.

From this menu, when manual override is not active, it is possible to run fluid sequences directly when their associated buttons near the bottom of the menu (f) are pressed. When active, functions and outputs will indicate their status and let a sequence be viewed in operation from this menu.





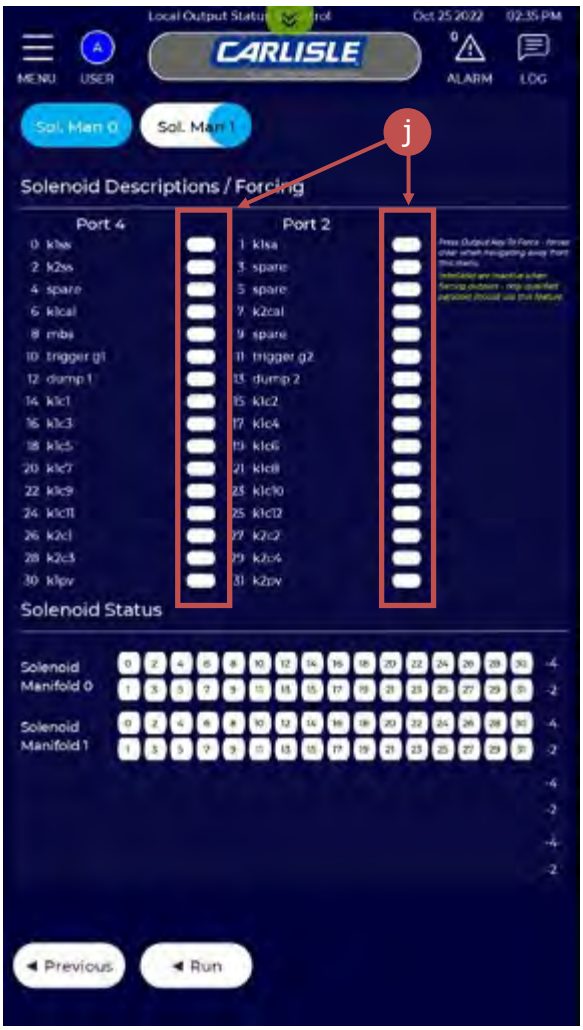

Press the "Pressure Regulators" button (g) on the Local Fluid Control menu to open the menu shown below.

From this menu, manual override mode can be activated and deactivated, and all configured pressure regulators can be operated manually.

Press the "Previous" button (h) to return to the Local Fluid Control Menu


Press the "Solenoid Forcing" button (i) from the Local Fluid Control Menu to open the menu shown on the right. This menu is only available if manual override is selected.

From this menu, each installed solenoid is forced on or off when the button (j) to the right of the output descriptions is pressed.




**⚠ WARNING**

Output interlocks are not observed in this mode.

## SHUTTING DOWN THE SYSTEM

Before shutting down, it is desirable to purge any material that is in tubing to prevent it from clogging fluid tubing, etc.

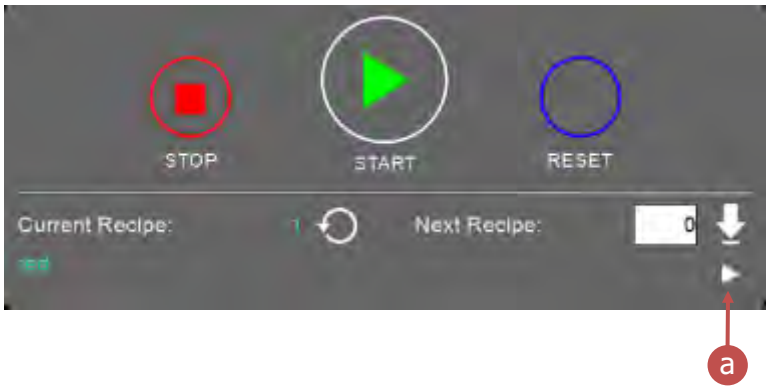
All recipes have a "Purge All" sequence designated and when the supervisory controller calls a purge command, the system will run that sequence.

To purge from the HMI – press the triangle (a) button on the bottom right of the start panel on the main run page.

All sequences that have been configured for the selected station will be shown (b) in place of the recipe selection information in the run panel. To run a sequence, the RF2 must be in "Run" mode, and all interlocks from other systems must be ok. Press the button for the sequence that is desired, and it will run.

For the shutdown purge, press the button corresponding to the sequence that has been programmed to purge all material. "Purge All" for example.

After the purge sequence has been completed, you can proceed to shutdown the system using the power switch on the right of the system's enclosure.



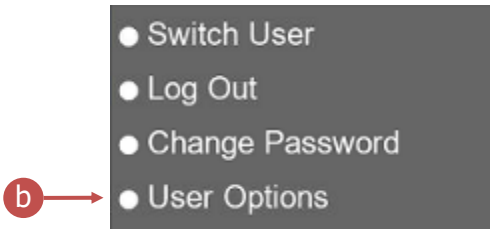

# ADMINISTRATOR FUNCTIONS

Users that are members of the "admin" group can access functions not available to other users and to modify access for other users.

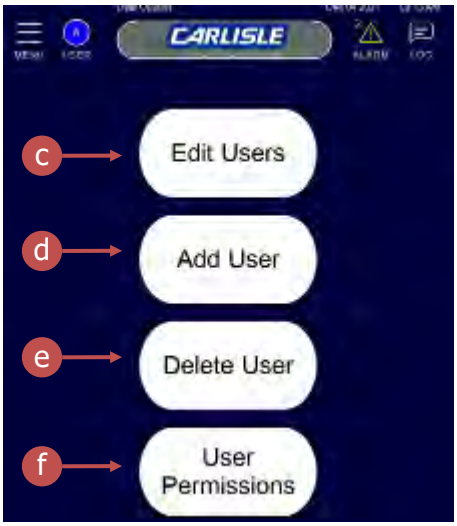
## User Options

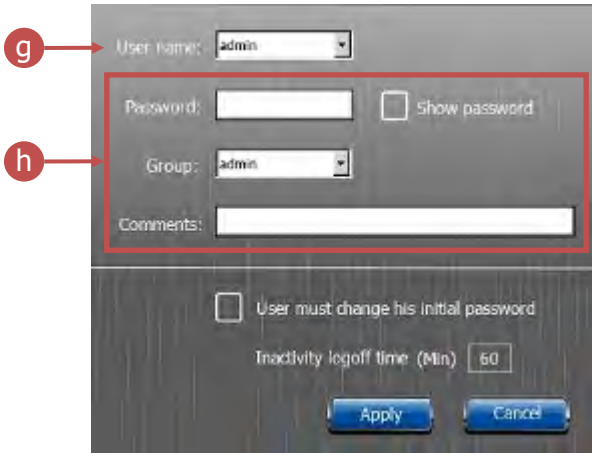
To access the user options page, log in as an administrator and then press the "user" (a) menu key to open the user actions dialog.


A dialog box will open and the administrator will see an option called "User Options" (b).




From the user options menu you can Edit users (c), Add users (d), Delete users (e), or change User permissions (f).




## Edit User

To edit a user, press the Edit Users menu.

Select the user you want to edit (g)

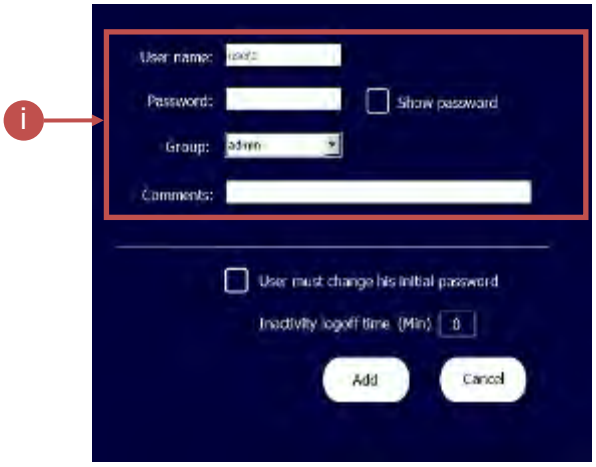
Modify the user's parameters (h). This includes user-group assignment.

## Add User

The operator interface supports up to fifty individual users.

To add a user, enter the Add User menu.

Fill in the parameters (i) including user name, group assignment and initial password.

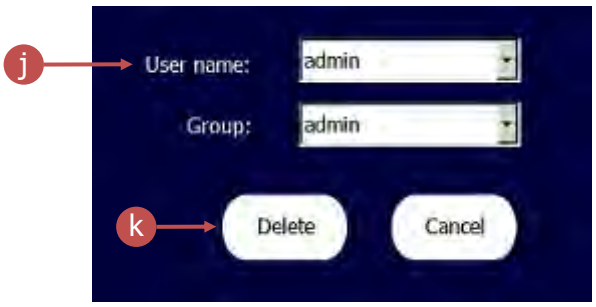



## Delete User

To delete a user, enter the Delete User menu.

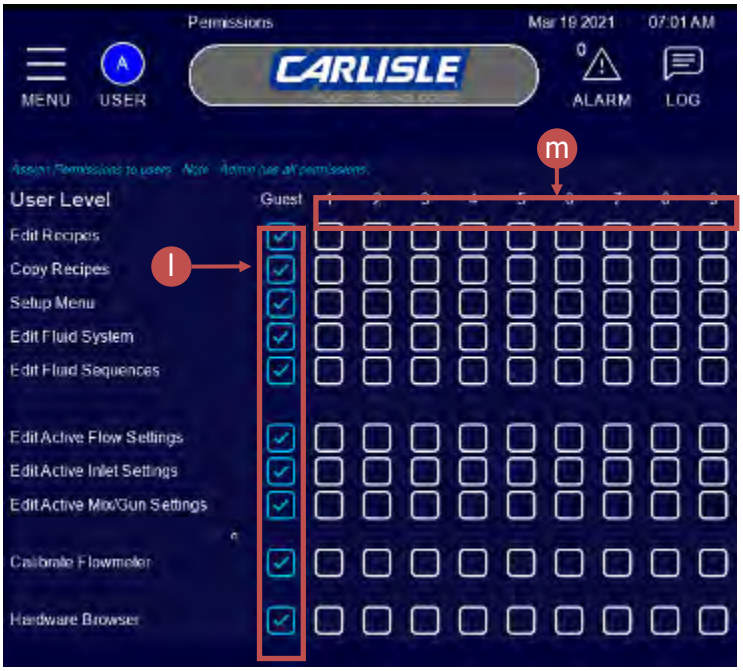
Select the user (j) you want to delete.

Click on delete (k).




## User Permissions

Various functions within the operator interface can have their access controlled depending on their group assignment. See more details about this in the "Security" section in the "Process Configuration" chapter. To assign rights to different user groups, enter the "User Permissions" menu from the User Options menu, and select or deselect access for each function (l) by user level (m).

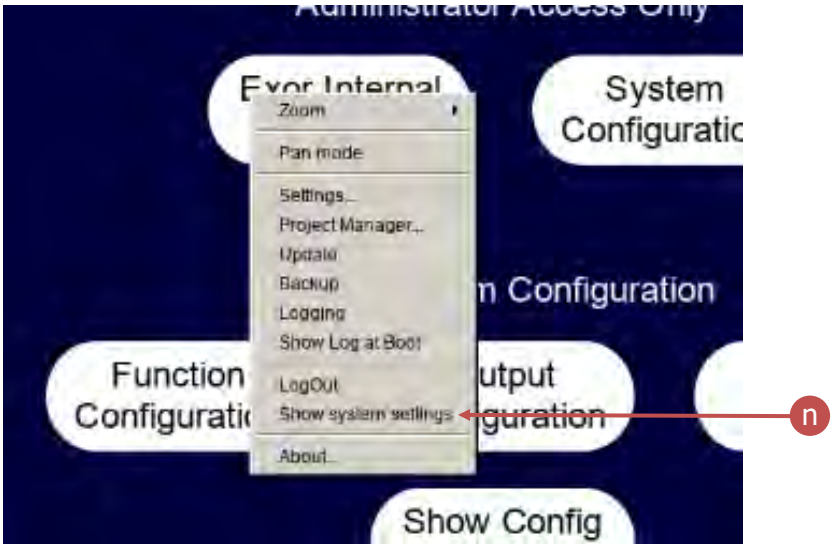


## Disabling Cloud Access

Although the cloud access feature of the RF2 is an appropriate manner to allow diagnosis, troubleshooting and updates to the equipment, some customers may not want to use this type of service.

Access to the RF2 via Exor's Corvina Cloud service can be disabled in two ways:

1. Disconnecting the RF2's physical "Cloud" RJ-25 port from a network connection.
2. Through the Exor's internal menu:




From the settings menu (when logged in as an administrator), press "Exor Internal Menu" and select "Show system settings" in the dialog box that opens (n).

In the settings menu that opens, press "Services" and then "Cloud Service" to access the menu shown below.


In the Cloud Service menu, press "Edit" (o) at the top right, and then click the "Enabled" slider to disable the service (p). Press "Save."

Press Back, Menu, Exit to return to the runtime environment.

**⚠ WARNING**

Though unlikely, a malicious actor having access to the RF2 via the cloud service would have the ability to activate the unit remotely. The greatest hazard in this case is the potential for the release of chemicals while no personnel are present. However, this hazard is mitigated if the air and fluid supplies to the RF2 are deactivated when no personnel are to be present as recommended in the safety section.

If it is suspected that someone has unauthorized access to your RF2. Contact your Corvina Cloud organization's administrator. This could be the distributor of your equipment. If this information is not known, contact Carlisle Fluid Technologies.

## SETUP

To access the main setup menu, select "Setup" from the main pull-down menu.

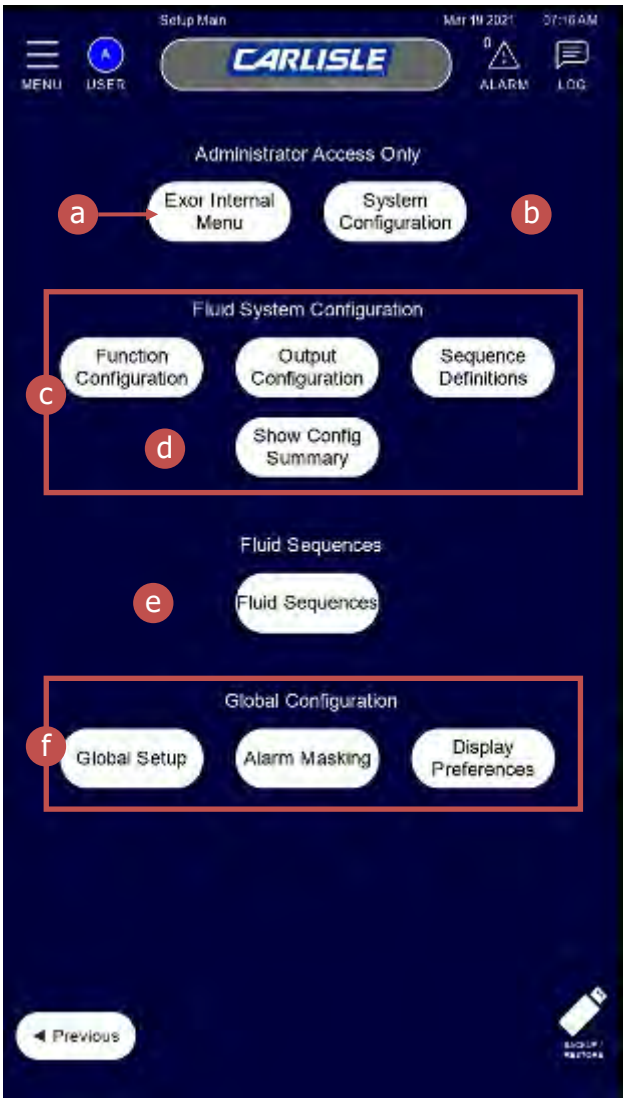
On the main setup page, the top two selections are available only to administrators. These are "Exor Internal Menu" (a) that opens a popup dialog to allow internal settings for the Exor operator interface to be modified, and "System Configuration" (b) that opens the system configuration menu.

The next group of selections involve setting up the "Fluid System" (c) which involves setting up outputs, functions, and overall sequence definitions and settings.

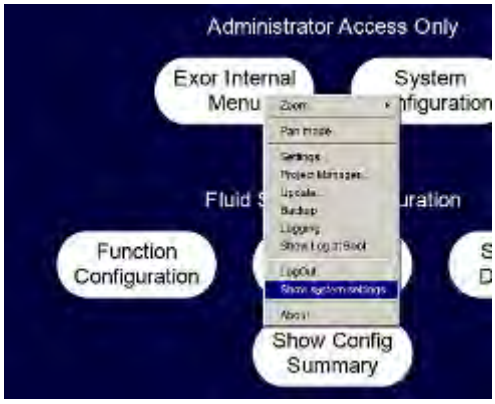
These selections are access-controlled by the administrator. The "Show Config Summary" (d) button will open a page showing an overview of the system configuration.

The "Fluid Sequences" (e) selection allows individual fluid sequences, including step timing and order of operations to be modified. This menu is access controlled by the administrator.

The final group of menus (f) are for modifying several miscellaneous parameters used by the system that dictate its behavior.



## Exor Internal Menu




The dropdown dialog allows access to the root settings for the Exor operator interface's internal settings. Setting IP addresses for the three networks provided with the interface (described in the Installation section above), and setting the date and time displayed on the panel are the only operations that are necessary to operate the RF2.

For more information, consult the user manual for the Exor eX715 operator interface.

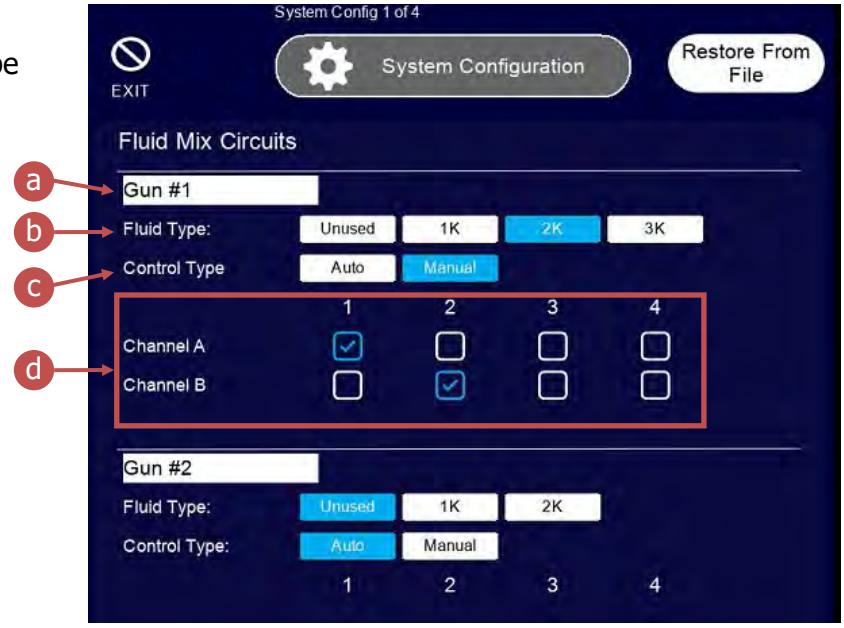
## System Configuration

System configuration is a group of four menus that are used to define the hardware installed on the RF2:

- Fluid Mix/Guns
- Channels
- Stations and AnyBus Gateways
- Solenoid Manifolds, Pressure/Regulators, and Analog Outputs

## Fluid Mix/Guns

The first page allows the Fluid Mix/Guns to be configured.




Definitions for each Gun/Mix include:

1. **Description**: Each unit can be named –this name will be displayed on the main menus and will be what is used for referencing the gun/mixer.
2. **Fluid Type**: Unused, 1, 2, or 3 component fluids.
3. **Control Type**: Auto, Manual Pulse (Future), Manual Analog (Future).
4. **Channel Selections**: Depending on the fluid type selected, Channels A, B, and C may be available. These can be mapped to physical channels 1-4.

**NOTE**

Since only four channels are available to the RF2, selections for one of the four gun/mix units will affect the availability of others. For example, if 3k is selected for Gun/Mix 1, then only 1K will be available for the other three units, only one of which will be allowed to use the remaining channel.

**NOTE**

A physical channel can only be mapped to one channel of one gun/mixer. When one is already selected elsewhere, it will be deselected in the other location.

## Channels

Press "Next" to open the next system configuration menu, for configuration of channels.

Channels that have been selected for use by a gun/mixer in the first system configuration menu will be available for configuration on this page.

Definitions for each channel include:

a. Description: Each unit can be named–this name will be displayed on the main menus and will be what is used for referencing the channel.

b. Flow Control: The type of flow-actuation device that is used by the channel.

- MVR: A Material Volume Regulator is used to control flow.
- Pulse: Fluid flow is controlled by a pulsing valve. This option is only available for secondary (B or C) channels in a gun/mixer.
- Feedback Only: Flow is not controlled by the RF2 such as with a manual gun. This option is only available for manual systems on the master channel (A).

c. Inlet Pressure Regulation: Select if a pressure regulator is to be used with a flow control device.

d. Feedback Type:

- Square Wave: Flow feedback is given by the flow meter pulse connected to a High-Speed-Counter input on the I/O block.

## Stations and AnyBus Gateways

Press the "Next" button to open the next system configuration menu, for further configuration.

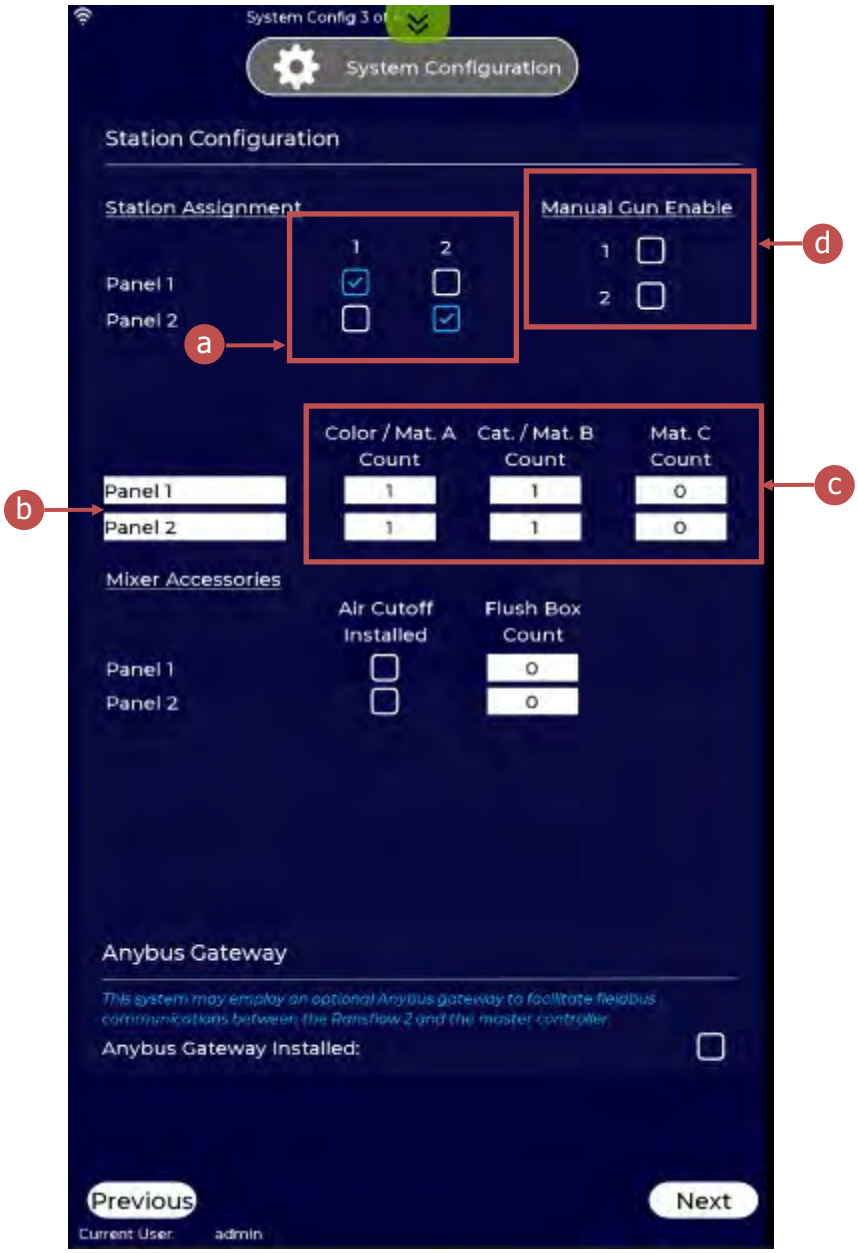
Station definitions include:

a. Station assignments: Each gun/mixer configured can be assigned to either panel #1 or 2.

b. Description: Description of each station that is used to reference stations throughout the operator interface.

c. Material Counts: For each channel, the amount of solenoid valves available for materials.

d. Manual Gun Enable: Enables manual gun for either station #1 or 2.



e. Mixer Accessories: Enables the configuration of two new options:

1) Air Cutoff Installed–Check this box when an air cut-off box is installed on a mixer that does not use one or more flush boxes. When enabled, the trigger 1 (one) and trigger 2 (two) outputs of the corresponding mixer will be turned on and off when the assigned station is started or stopped. The trigger outputs are plumbed to the air cut-off box solenoids to disable the atomization air for each gun. When a flush box is installed, the flush box controls the air cut-off. When the Flush box is set, the count to a value greater than 0 will disable this option. This option does not affect mixers configured for auto mode.

2) Flush Box Count–Set this field to match the number of flush boxes connected to a mixer. This option does not affect mixers configured for auto mode.

f. AnyBus Gateway: If the HMS AnyBus gateway is used for communications with supervisory processes, this box (f) must be selected.

## Solenoid Manifolds, Pressure/ Regulators, and Analog Outputs

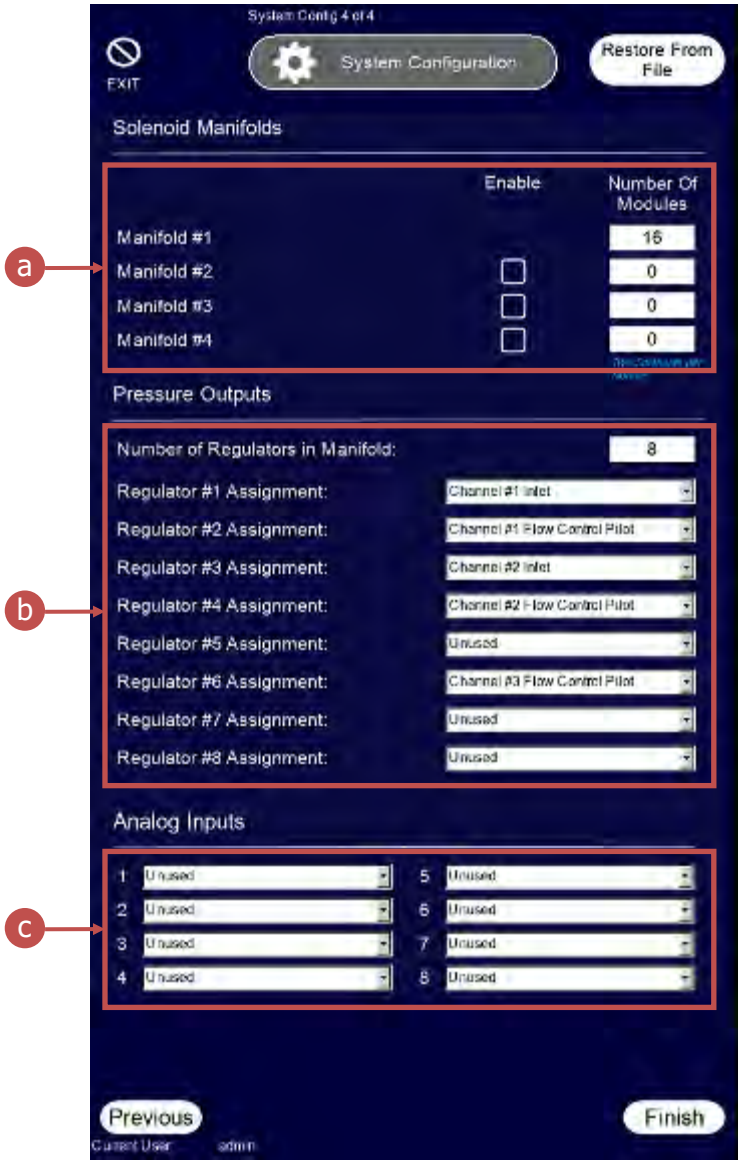
Press the "Next" button to open the next system configuration menu, for further configuration.

a. Solenoid Manifolds: Up to four solenoid manifolds may be used by the RF2 (each having up to 16 2-solenoid modules). Manifold #1 is always enabled and must be used.

b. Pressure Outputs: The RF2 can control up to eight pressure regulators. In this section, define the amount of regulators that the RF2 will control, and the assignment for each regulator.

- Regulator assignments include:
  - Channel 1-4 Inlet Pressure Control Pilot: Pilot signal (0-100psi) to a DR1 or equivalent pressure regulation device.
  - Channel 1-4 Flow Pilot: Pilot signal (0-100psi) to an MVR or DR1 that is used for controlling flow.

c. Analog Inputs: The RF2 has eight Analog Inputs that can be utilized for different purposes:

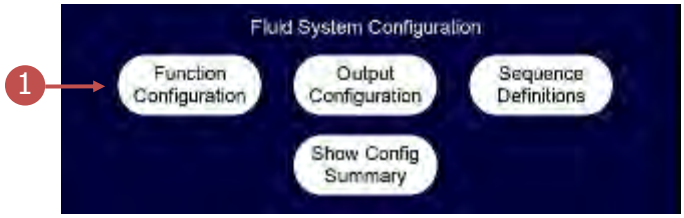



- Unused: The analog input is not used by the RF2.
- Gun/Mix 1-4 Flow Command: Used as the flow command from an external/supervisory process (PLC or Robot, etc.).
- Channel 1-4 Inlet Pressure: For gear-pump flow actuators, the inlet pressure feedback from an installed sensor.
- Channel 1-4 Outlet Pressure: For gear-pump flow actuators, the outlet pressure feedback from an installed sensor.
- Channel 1-4 Analog Feedback: Analog input is connected to an analog type flow meter for the channel.
- Station 1-2 Solvent Flow Meter Feedback: Analog input is connected to a solvent flow meter which is used to verify that enough solvent was used per sequence.

Press the "Finish" button to save the system configuration parameters and reboot the RF2.

## Function Configuration

To access this menu, press the "Function Configuration" button (1) in the Setup Main Menu.




In this menu, the functions can be selected along the left side of the menu. There are fifty functions available per station, pressing the arrow keys toward the bottom of the function list will page up and down.

When a function is selected, its configuration information is shown on the right-hand side of the menu. These parameters can be modified by changing the parameters

Parameters that can get changed are:

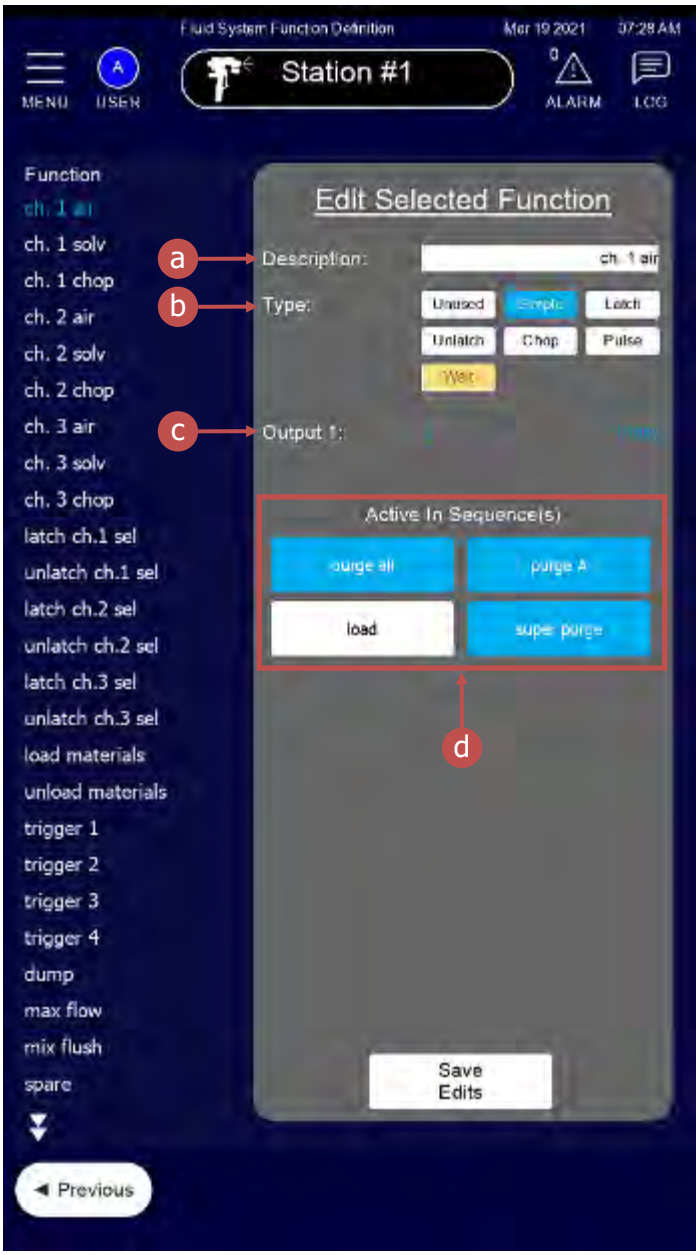
a. Description: Description of the function selected–often this mirrors the output it works on.

b. Type: Type of function. For more information, consult the section System Configuration–Terminology –Functions

c. Output 1:

- For simple, latch, unlatch and pulse types–this is the output that is acted on when the function becomes active.
- For chop type functions, this is the first output that is active when the two outputs are toggled.

d. Active in Sequences: Select all sequences for the selected function to be used.



## System Outputs

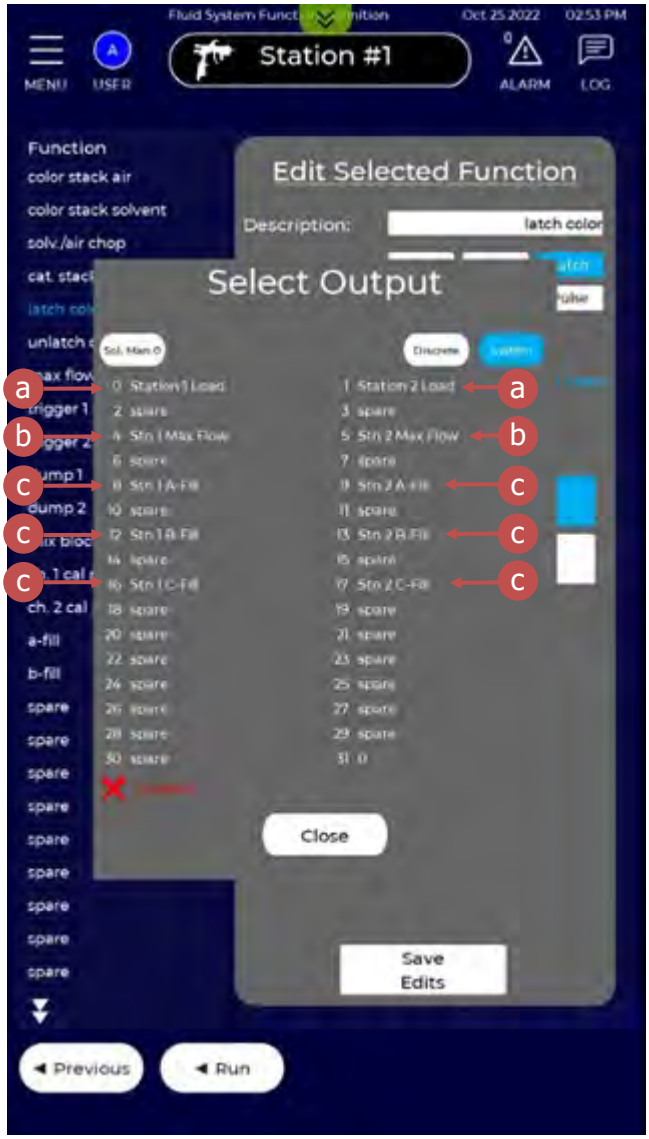
System outputs are predefined outputs used internally to the system to activate certain features, etc. Just like configured outputs, these are called by functions.

Options available are:

A. Station "x" Load–when active, the material valve (s) for the selected recipe for the station will be active.

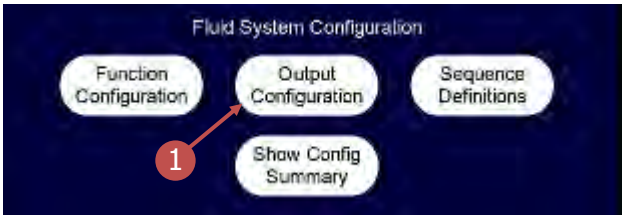
B. Stn "x" Max Flow–when active (to be used during a load sequence), the flow command for the Gun/ Mixer will be the recipe defined "Sequence High Flow Rate." Materials will mix on ratio at this rate instead of the "Default Flow Rate"

C. Stn "x" A,B, or C Fill–when active the A, B, or C channel for the station will be forced to 100% open. This is typically used by purging operations or for quickly loading material to the flow meter.



## Function Configuration

To access this menu, press the "Function Configuration" button (1) in the Setup Main Menu.




In this menu, the functions can be selected along the left side of the menu. There are fifty functions available per station, pressing the arrow keys toward the bottom of the function list will page up and down.

When a function is selected, its configuration information is shown on the right-hand side of the menu. These parameters can be modified by changing the parameters

Parameters that can get changed are:

a. Description: Description of the function selected–often this mirrors the output it works on.

b. Type: Type of function. For more information, consult the section System Configuration–Terminology–Functions

c. Output 1:

- For simple, latch, unlatch and pulse types–this is the output that is acted on when the function becomes active.
- For chop type functions, this is the first output that is active when the two outputs are toggled.

d. Active in Sequences: Select all sequences for the selected function to be used.


**NOTE**

System outputs that can be interlocked to the S1 or S2 load identify a material valve set to on and–for example–interlocked with solvent or air signals. As a result, it is not necessary to interlock various CCV outputs from one to the other because the RF2 can only operate one CCV output number at a time.

## Output Configuration

To access this menu, press the "Output Configuration" button (1) in the Setup Main Menu.

Along the top of this menu, the various solenoid manifolds that are installed in the system, and the discrete (hardwired) outputs can be selected (a). Only manifolds that are installed will be visible for selection.

Selecting a manifold causes the list of solenoids in the manifold (b) to be updated. Each Output on the manifold (0-31) can be selected. Note, the outputs are arranged in two columns (Port 4 and Port 2) and their orientation represents the view of the back of the solenoid manifold, looking at the air connections.

Selecting one of the outputs will cause the Selection Details (c) to the right side of the menu to be updated, and the interlocks (d) to be updated.

Output Interlocks prevent two incompatible outputs from being active at any given time. Up to twenty interlocks can be programmed for any individual output. To select or deselect an output as an interlock, simply press the button representing the interlocked output.

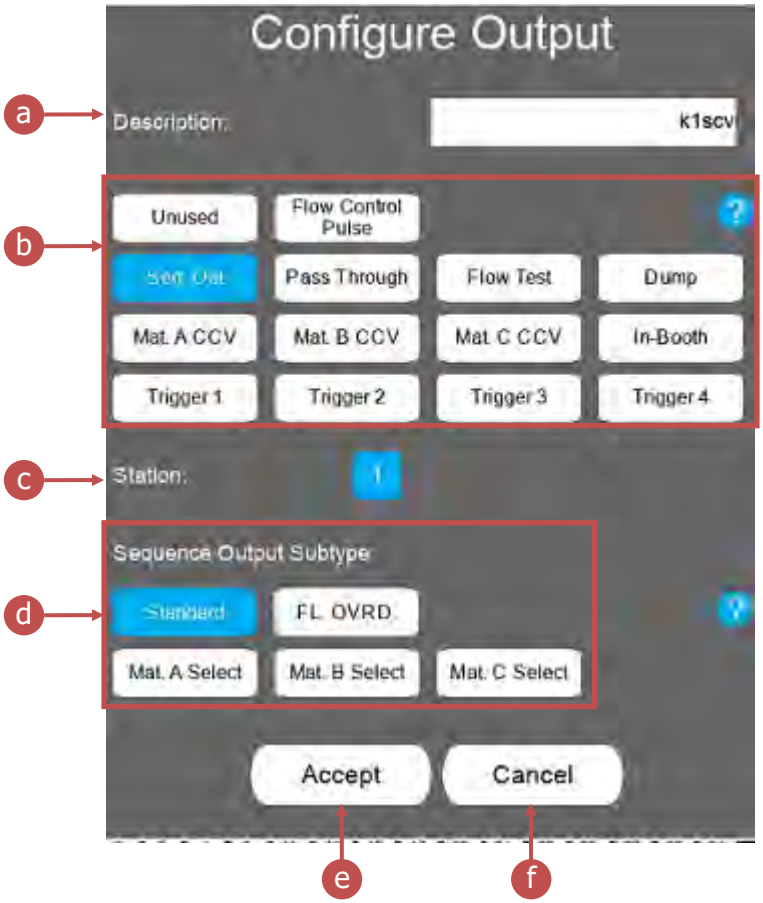
If you want to swap outputs, press the "Swap Outputs" button (e). This process is explained later.

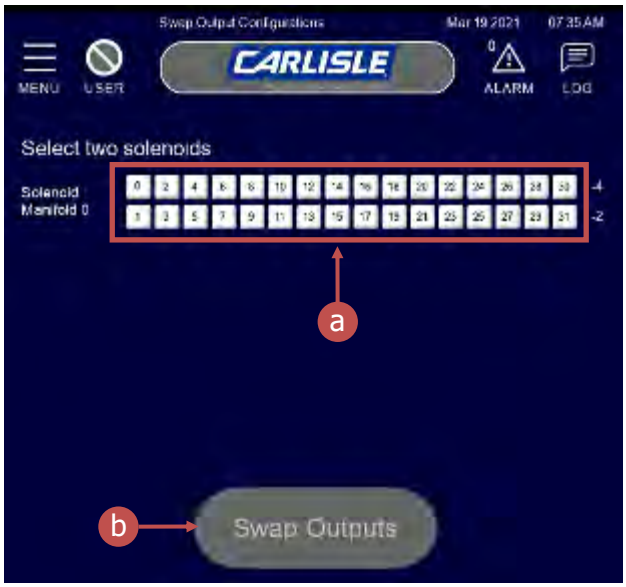
To modify the output details, press the area showing the selection details–this will open a popup dialog menu (see on next page).

Parameters to be modified in the "Configure Output" popup menu are:

a. Description: Description of the output–it is recommended that each output be labeled the same as any tubing labels that are connected to the solenoid valve.

b. Output Type Selection: See more about different output types in the section–System Configuration-Terminology–Outputs in page 17.




- Dump–output acts as a trigger and flow will be expected when this output is on.
- In-Booth: Alarm indicator "Wink-Eye" for in booth controller accessory.

c. Output ID: Depending on the type selection, different values will be asked for:

- Station Number: For Sequence Output or Material CCV output types, this represents the station that the output is assigned to.
- Mix/Gun Number: For Trigger output types, this represents the gun or mixer that the output is assigned to.
- Channel Number: For "Flow Test" output types, this is the channel that the output is assigned to.
- Input Number: For "Pass Through" output types, this is the input ID that will affect the output.

## System Outputs

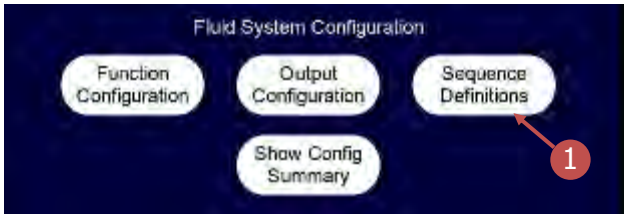
System outputs are predefined outputs used internally to the system to activate certain features, etc. Just like configured outputs, these are called by functions. Options available are:

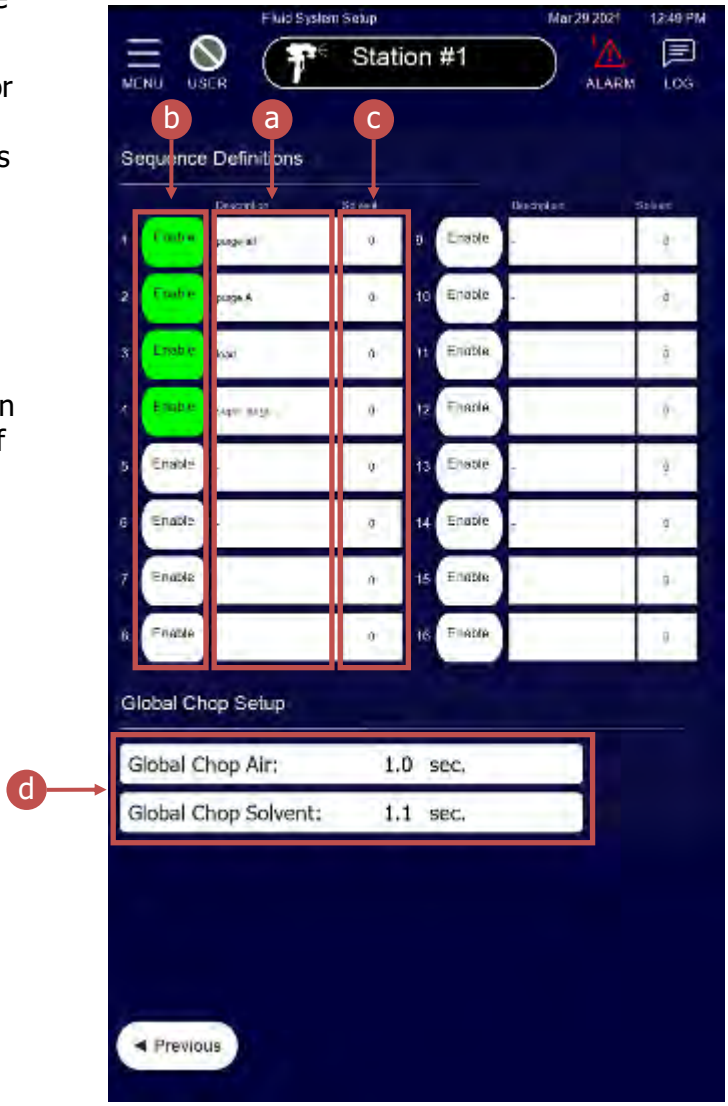
- Station "x" Load–when active, the material valve (s) for the selected recipe for the station will be active.
- Station "x" Max Flow–when active (to be used during a load sequence), the flow command for the Gun/ Mixer will be the recipe defined, "Sequence High Flow Rate." Materials will mix on ratio at this rate instead of the "Default Flow Rate"
- Station "x" A, B, or C Fill–when active the A, B, or C channel for the station will be forced to 100% open. This is typically used by purging operations or for quickly loading material to the flow meter.

## Sequence Definitions

On the Sequence Definitions Setup Menu (1), up to sixteen programmable sequences can be given names (a), and enabled or disabled (b) depending on whether they are necessary for the user's process. If a solvent flow meter is used for the station, enter a "solvent-check" value (c) which will be compared to the actual solvent used during a fluid sequence do generate an alarm if not met.

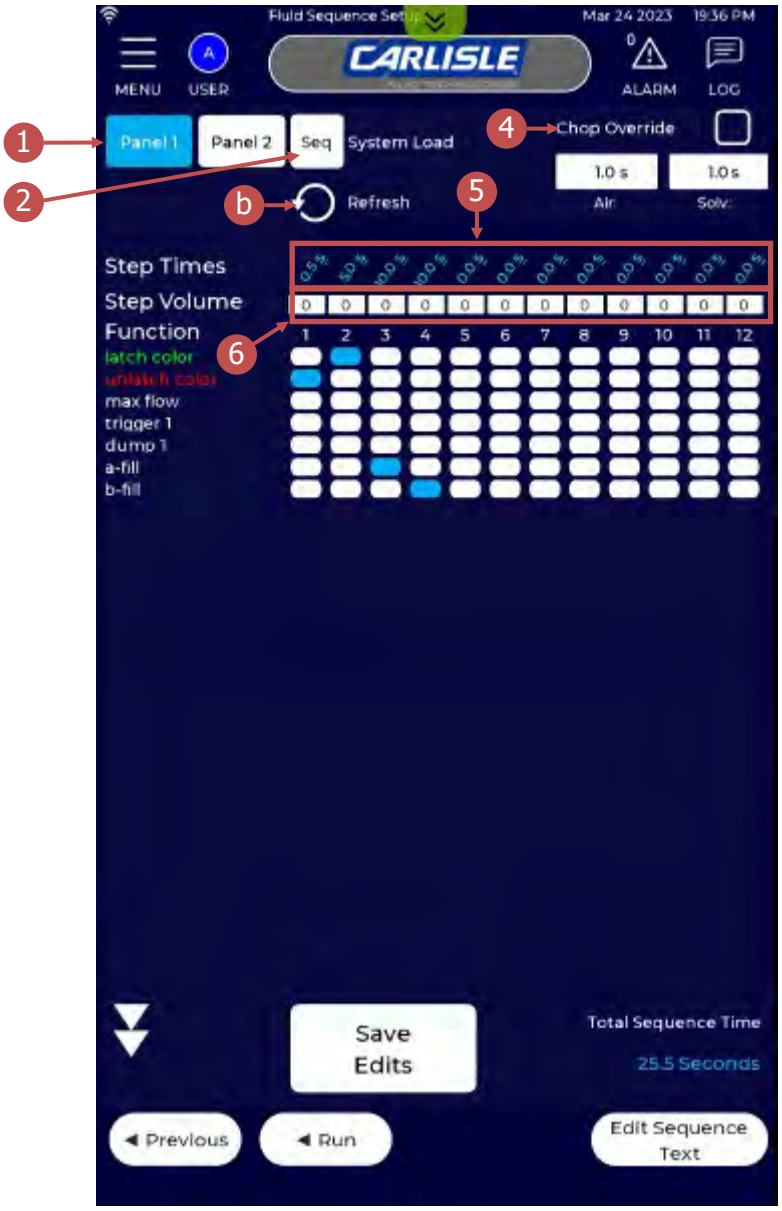
Additionally, global values for chop timing (air and solvent on times) (d) are programmed here.



## Fluid Sequences

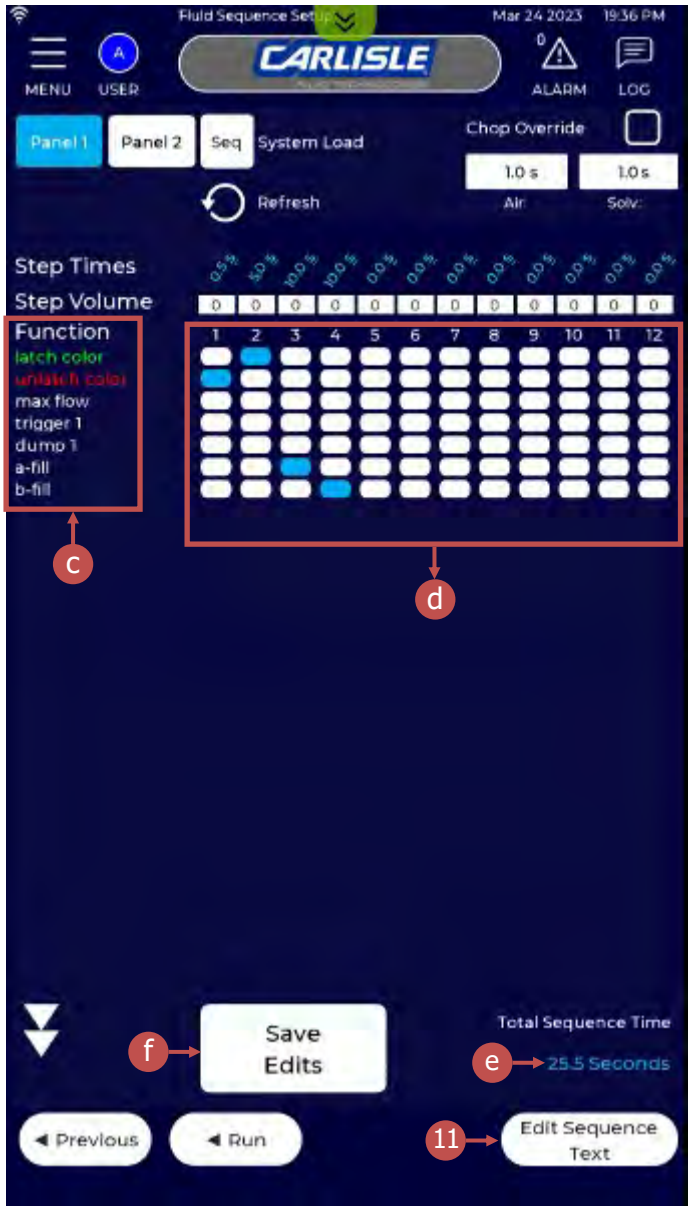

The Fluid Sequence Setup menu allows individual sequences of valve operation to be programmed. Sequences may be used for loading or purging of materials, as well as for other operations, such as bell cup wash, etc. When a sequence is called from the main menu, or from a supervisory process, the sequence will operate. To open this menu, press "Fluid Sequences" (a) in the Setup Main Menu.




To change a sequence:

1. Select the panel by pressing "Panel 1" or "Panel 2" buttons. The selected panel will be highlighted.
2. Select the Sequence to edit by pressing the "Seq" button or the description to its right. This will open a popup dialog which will allow the sequence to be selected from the list of available sequence definitions.
3. When the panel or sequence is changed, or when the refresh (b) button is pressed, the stored parameters will be loaded into the edit fields below.
4. Chop Override: If global timing values for chop air and solvent are not desired, enabling this feature allows these times to be entered in the fields below.
5. Set step times for 12 steps. If a step is not required, enter 0 seconds.
6. Step Volume: The minimum volume that must flow during each step before the next step. The step volume is measured as the total sum of all mixers configured for the current station; configure the sequence to ensure the calculated volume follows the desired flow path. For the sequence to progress to the next step, both the Step Time AND the Step Volume values must be met. The system will wait until enough volume has flowed through the system or until the Step time has passed, whichever takes longer.

7. The list of functions (c) that are used in the selected sequence will be shown.
8. Each function represents a row in the sequence and pressing the buttons (d) in each column will enable or disable the function in the given step. Buttons are highlighted blue when selected and white when not.
9. The total sequence time (e) is shown near the bottom of the page.
10. When finished with edits, press "Save Edits" (f) to store them in memory so that they can be used.
11. Edit Sequence Text: Opens the sequence step description editor window.



12. Sequence Descriptions: The sequence description editor lets the user add user-defined text that is displayed for each step of a sequence. Each sequence has its own set of 12 user-defined strings. The default values (g) are shown below.

    The text fields on the sequence description editor page are the same as the field on the sequence run window. The text entered on this page will also appear on the sequence run window.

    The sequence descriptions are not enabled until the user enters the sequence descriptions window and saves their changes.


**NOTE**

The user text entered on this page will not be translated when the system language is changed.

## Global Setup

To modify several parameters that affect system behavior regardless of the recipe that is loaded, press "Global Parameters" (1) on the Main Setup Menu.

Parameters that are not relevant based on the system configuration will not be shown.

More information about the various parameters is given in "Process Configuration"–Global parameters.

## Alarm Masking

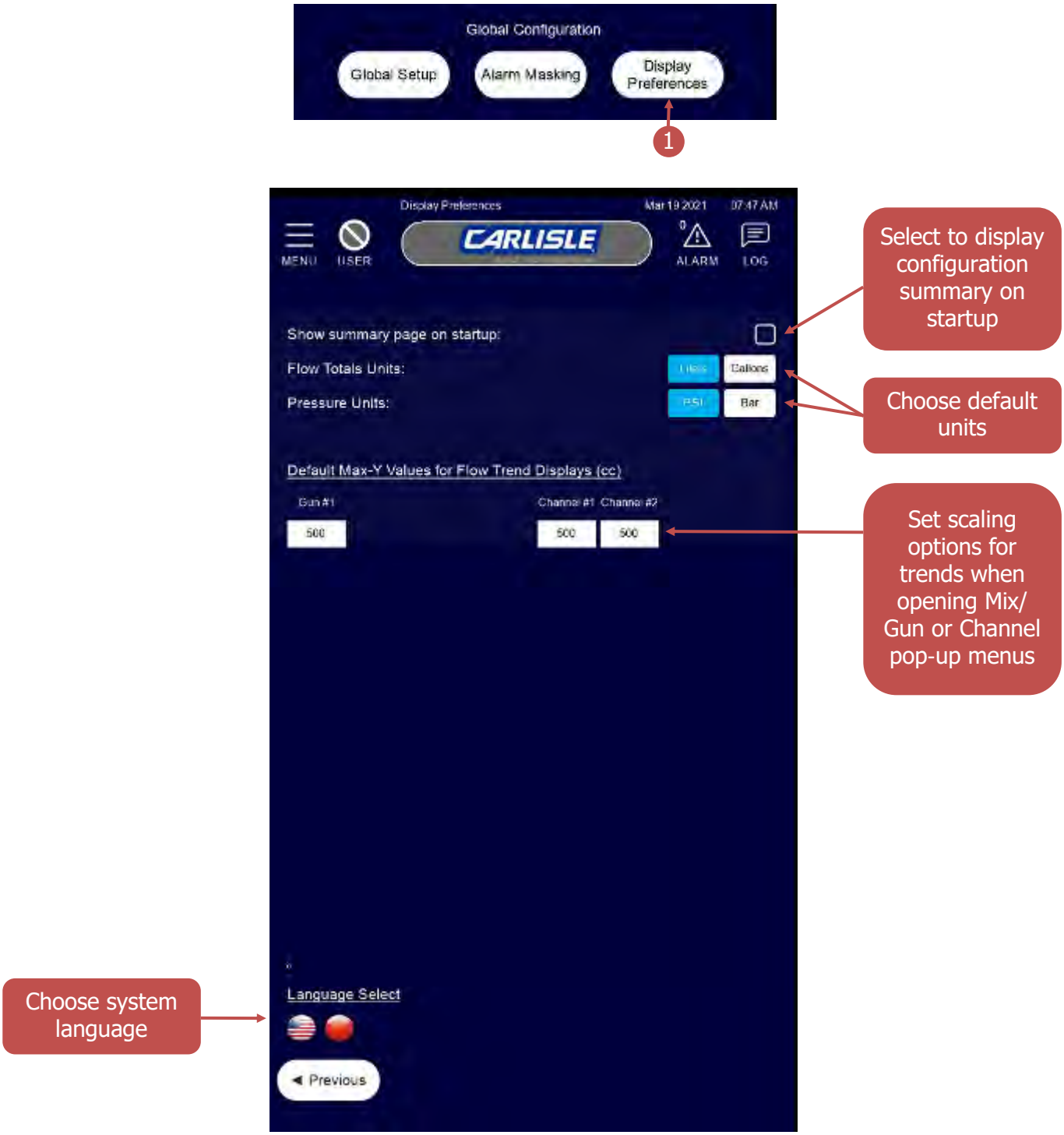
You can setup various system alarms to cause the system to shut down spray or, if deselected, they will provide a warning while the system keeps running. To do this, press "Alarm Masking" (1) in the Main Setup Menu.

Not all available alarms are shown here, as some alarms will always result in spray shutdowns or warnings.

Selecting "Disable Audible Alarm" (a) disables the alarm horn from chirping when an alarm is activated.


## Display Preferences

The display preferences menu allows various items to be changed that do not affect system performance, but affect the way that data is displayed to the user, to include language and unit of measure selections.



## BACK-UP/RESTORE

All stored settings, including recipe data, global setup data, fluid system configuration and sequences, etc. can be backed up to a USB stick or restored from USB or other media.

Additionally, this data is automatically backed up to SD card daily, with each daily archive being stored for one year before being deleted.

This functionality allows the entire system configuration (or individual parts of it) to be passed from one RF2 to another or restored in the event of a system failure resulting in the loss of data.

To access the backup and restore menu, navigate to the Main Setup Menu, and click on the "Backup/ Restore" (1) icon on the lower right of the page.

When clicked, the system will display the screen below.

## Back-Up Data

To backup to USB, first connect a USB flash drive into the USB port provided on the front of the control enclosure (a). The system will indicate that a device is found (b). To eject the USB drive, press the "Eject USB" button (c) and follow the prompts.

When a USB stick is detected, each row will have a "Store to USB" (d) file available. When pressed, any of these stored .CSV file with the contained information is selected. The "All System Data" row (e) will store ALL system information.

It is possible to open and view the above file with software capable of viewing .CSV files such as Microsoft Excel.


## Restore Data

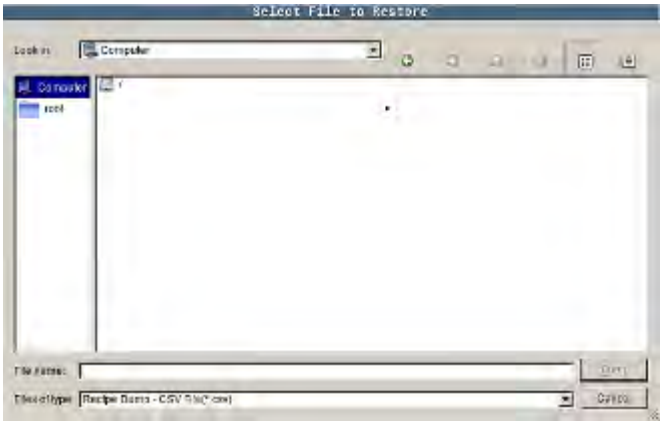
Press the "Restore" button (f) on any row to open a file dialog to access the operator interface's file system (including the USB drive and SD Card), etc. to look for the appropriate .CSV file.

The file restore dialog can be resized.

Within the operator interface file system, which is Linux based, the following paths are commonly used, and may contain file information.

- /mnt/sdcard (contents of SD card inserted in the slot).
- /mnt/usbmemory (contents of USB card inserted).

Once the file is found in the navigation menu, opening the file will restore the row selected. Note, if an invalid file is selected, the data will not be restored, and a warning message will be displayed.

# DIAGNOSTICS

The diagnostics menu contains miscellaneous functions for further diagnosing the RF2. Navigate to the diagnostics menu by pressing the "Diagnostics" pushbutton on the main dropdown menu.

## Audit Log Actions

The operator interface audits specific events such as user logged in, etc. From the diagnostics menu, it is possible to export the audit log to USB (in .CSV format), or to delete the audit log if desired.


**NOTE**

The RF2 web browser does not support all functionality for some of the pages. In special cases, a laptop may be needed to browse to those pages to perform certain tasks.

## Hardware Browser

Some of the ethernet-enabled devices that are used by the RF2 have built-in web pages that allow for further diagnosis. The Exor operator interface that is used by the RF2 has a browser that allows viewing of those pages.

The home screen of the device browser shows the RF2s PLC web page. Hyperlinks along the top of the menu access the web pages of the other available devices.

## Auxiliary Input Status

To check the functionality of inputs coming from auxiliary devices or some of the sensors that may be connected to the RF2, the Auxiliary Input Status menu allows the viewing of the input states.


## Restart HMI

The HMI can be rebooted from the Main Diagnostics Menu showcased in the previous page by pressing the button Restart HMI (a).

## DATA LOG/REPORTING

The RF2 stores flow total data and in the future, more detailed runtime data will be tracked. To access the main menu for data logging, press the "Log" button (1) on the right of the upper menu bar.


After pressing the button, the system will display the following screen,


### Flow Totals

The RF2 stores basic material flow data for viewing.

Data is organized by gun/mixer (a), time range (yearly, monthly, weekly, daily, hourly, grand) (b), by recipe (c)– or by all recipes. Data can be shown in liters or gallons (d).

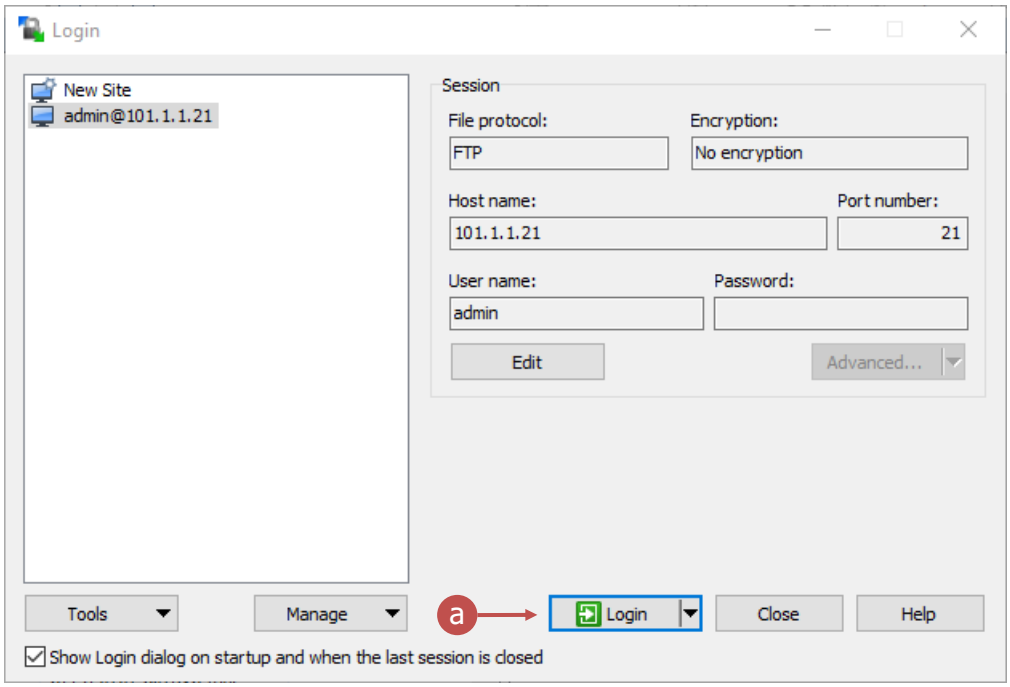
If more detailed data is needed for storage–it is best to connect the RF2 to a SCADA or supervisory PLC, and routinely poll the grand total, and other identifiers to store the changes in a database.

More information about connecting the RF2 to fieldbus can be found earlier in this manual starting on page 49 and in the Appendix starting on page 127.

## File Access Via FTP

Files stored on the operator interface, including daily archives of system settings, alarm logs, etc. can be accessed via FTP if a computer is connected to one of its three networks.

An FTP access program such as WinSCP may be used for this type of access. Use the following configuration to access the RF2 data.




To Log in–press the login button (a) and enter the credentials for any administrator user account configured.

**NOTE**

File transfer is allowed in both directions, but it is highly recommended not to overwrite any files that are stored on the system.

## MULTI-COLOR STACK LIGHT FUNCTIONS

The status/stack light is found on the top of the exterior of the RF2 control panel. The light will change color and/or flash depending on the status of the RF2. Each light function is defined below.

| LIGHT | FUNCTION |
|---|---|
| Green—Solid | Machine is in "RUN" state, and no trigger signal is present on any stations |
| Green—Flashing | Machine is in "RUN" state, and trigger signal is present on one or more stations |
| Red—Solid | Machine fault is present |
| Yellow—Solid | Warning indication, No fault is currently present |
| Blue—Solid | Pot life is nearing expiration |
| White—Solid | Machine stopped idle state, no system warnings or faults |
| White—Flashing | Exor (HMI) Communication Timeout, no system warnings or faults |
| Light Cyan—Solid | Machine is running in an active sequence state |

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# MAINTENANCE

## REGULAR MAINTENANCE PROCEDURES AND RECOMMENDATIONS

### Material Purge

After a job is completed, remember to thoroughly purge the system. Failure to do so can cause clogs, leaks, or cross-contamination of colors and material when the system is disassembled.

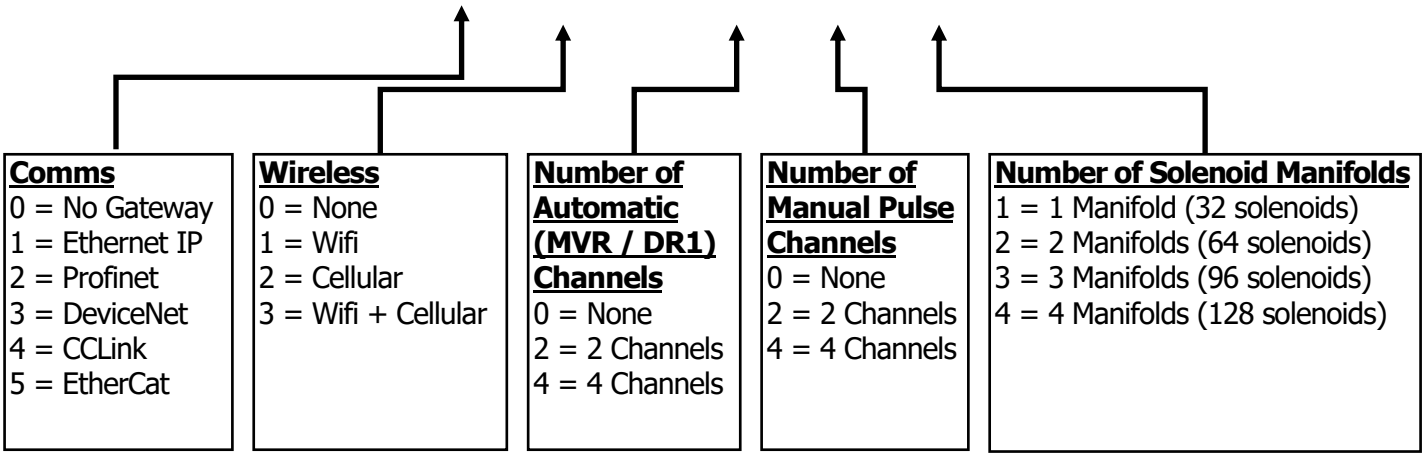
### Regular Inspection

Continuous use or lack of use of the system can cause a system malfunction. Do regular interval system inspections as shown at the table below.

| FREQUENCY | DESCRIPTION | INSPECTION METHOD |
|---|---|---|
| Daily | System flushed with solvent | Visual |
| Daily | Check for leaks | Visual |
| Daily | Clean spray guns | Visual |
| Daily | Check alarm history | Visual |
| Daily | Check for material supply | Visual |
| Monthly | Check static mixer for clogs | Visual |
| Monthly | Check all hoses for kinks and wear | Visual |
| Monthly | Perform flow meter calibration check | Test with beaker |
| Monthly | Check CCV operation | Trigger manually or from HMI |
| Monthly | Clean mix manifold and check valves | Disassemble |
| Monthly | Check fluid hoses for material buildup | Disassemble |
| As needed | Clean flow meter | Disassemble |
| As needed | Rebuild color change valves | Disassemble |
| As needed | Rebuild MVR valve | Disassemble |
| As needed | Replace static mixer assembly | Disassemble |

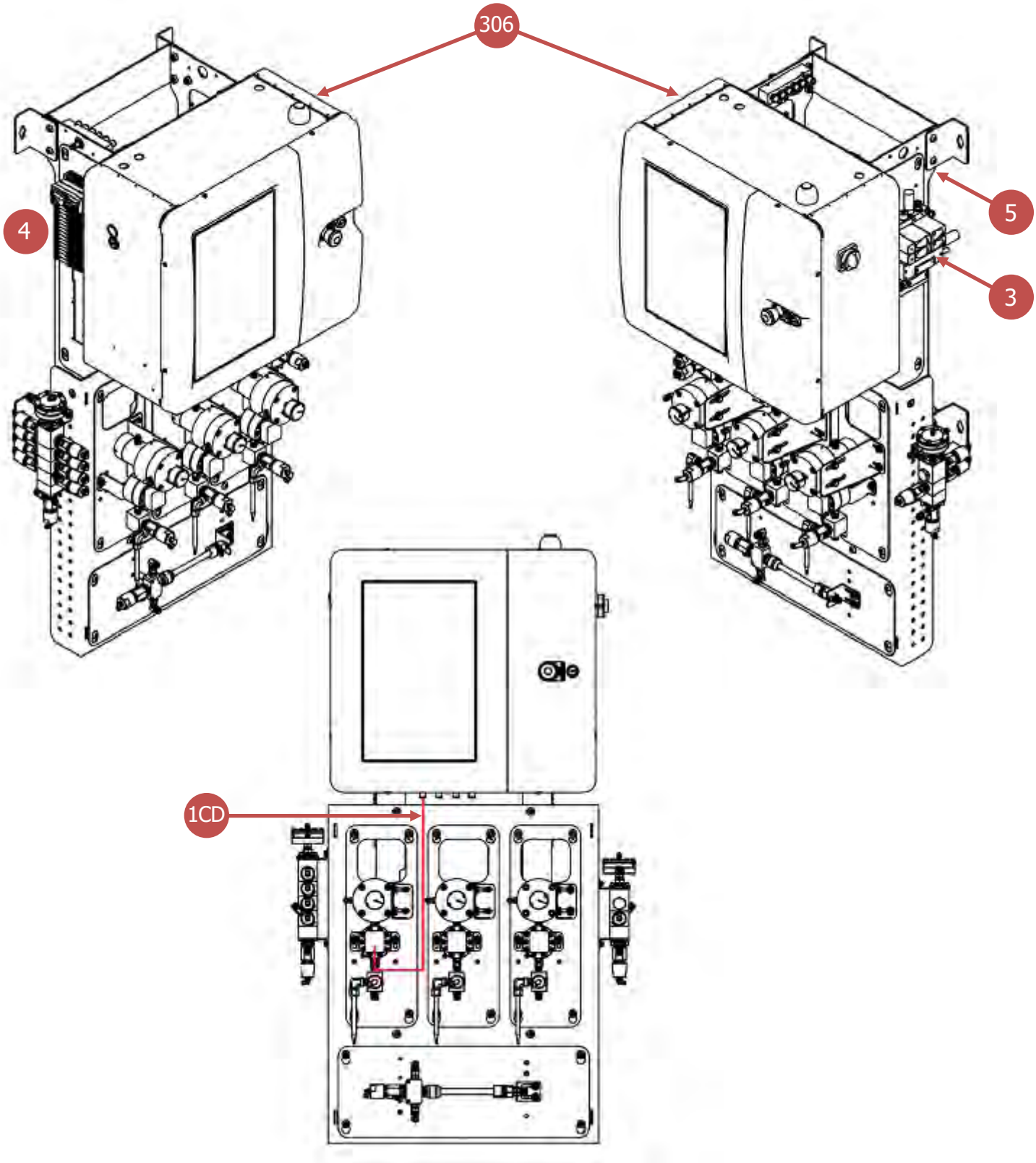
## TOP LEVEL PART NUMBERING

310-C##-###



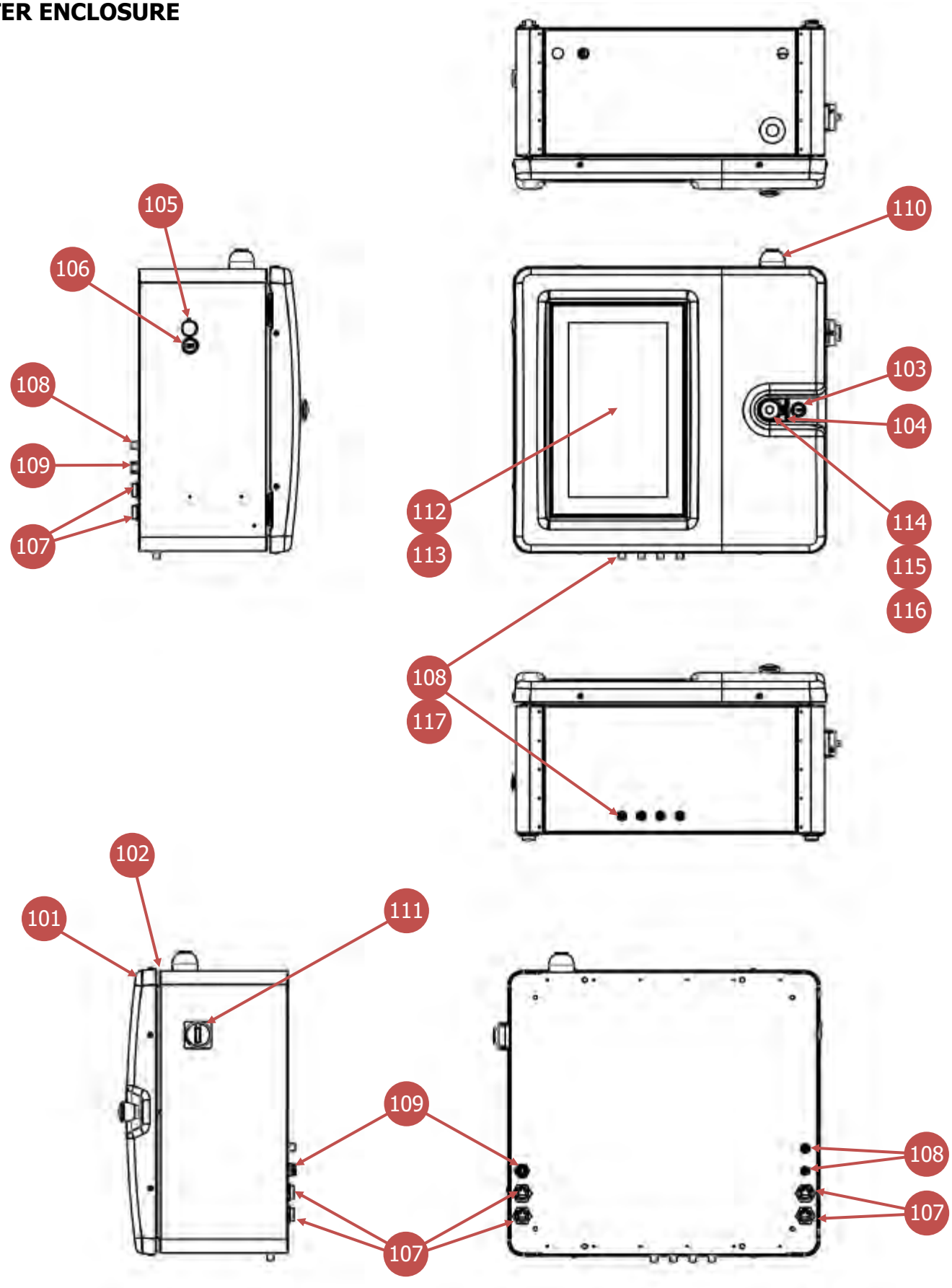
# COMPONENT VIEWS & SPARE PARTS

## RF2 CONTROLLER



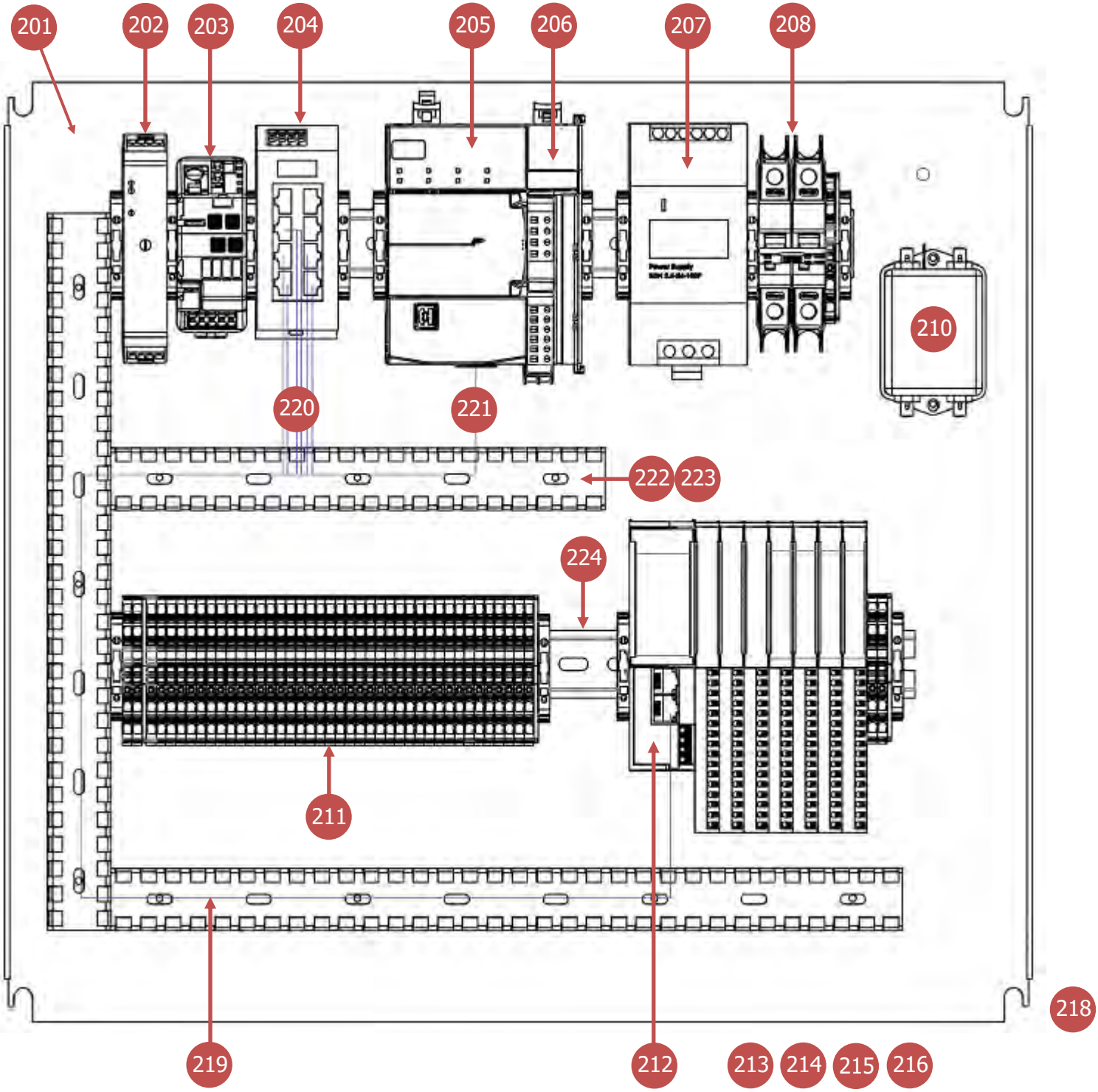
| RF2 CONTROLLER-TOP LEVEL | | | |
|---|---|---|---|
| **Item** | **QTY** | **Part No.** | **Description** |
| 1 | 1 | 310-5000 | Control Enclosure |
| 1CD | *See 1CD | - | Flow meter cables for different channel counts |
| 3 | *See Table 3 | 310-3940 | Pressure Regulator |
| 4 | *See Table 4 | 310-3960 | Solenoids |
| 5 | - | 310-2010 | Mounting Bracket |
| 6 | - | - | Cover-Pressure Regulators |
| 7 | - | - | Cover-Solenoids |
| **FLOW METER OPTIONS (DIFFERENT CHANNEL COUNTS)** | | | |
| **Code-Top Level Columns CD** | **QTY** | **Part No.** | **Description** |
| 0 | - | - | - |
| 02 | 2 | 310-4138 | M12-M12, 5PIN, 1M, SHIELDED |
| 04 | 4 | 310-4138 | M12-M12, 5PIN, 1M, SHIELDED |
| 06 | 6 | 310-4138 | M12-M12, 5PIN, 1M, SHIELDED |
| 08 | 8 | 310-4138 | M12-M12, 5PIN, 1M, SHIELDED |
| Z | 2 | 310-4138 | M12-M12, 5PIN, 1M, SHIELDED |
| 22 | 4 | 310-4138 | M12-M12, 5PIN, 1M, SHIELDED |
| 24 | 6 | 310-4138 | M12-M12, 5PIN, 1M, SHIELDED |
| 26 | 8 | 310-4138 | M12-M12, 5PIN, 1M, SHIELDED |
| 40 | 4 | 310-4138 | M12-M12, 5PIN, 1M, SHIELDED |
| 42 | 6 | 310-4138 | M12-M12, 5PIN, 1M, SHIELDED |
| 44 | 8 | 310-4138 | M12-M12, 5PIN, 1M, SHIELDED |
| 60 | 6 | 310-4138 | M12-M12, 5PIN, 1M, SHIELDED |
| 62 | 8 | 310-4138 | M12-M12, 5PIN, 1M, SHIELDED |
| 80 | 8 | 310-4138 | M12-M12, 5PIN, 1M, SHIELDED |
| **COMMUNICATIONS MODULE** | | | |
| **Code-Top Level Column A** | **QTY** | **Part No.** | **Description** |
| 0 | - | - | - |
| 1 | 1 | 310-4142 | GATEWAY, EIP-EIP |
| 2 | 1 | 310-4143 | GATEWAY, PROFINET-EIP |
| 3 | 1 | 310-4144 | GATEWAY, DEVICENET-EIP |
| 4 | 1 | 310-4145 | GATEWAY, CCLINK-EIP |
| 5 | 1 | 310-4146 | GATEWAY, ETHERCAT-EIP |
| **WIRELESS COMMUNICATION OPTION** | | | |
| **Code-Top Level Column B** | **QTY** | **Part No.** | **Description** |
| 0 | - | - | - |
| 1, 3 | - | 310-4170 | USB Wifi Module |
| 2, 3 | - | 310-4171 | Exor Cellular Module |
| 2, 3 | - | 310-4172 | Cellular Antenna |
| 2, 3 | - | 310-4173 | Antenna Cable |

## OUTER ENCLOSURE



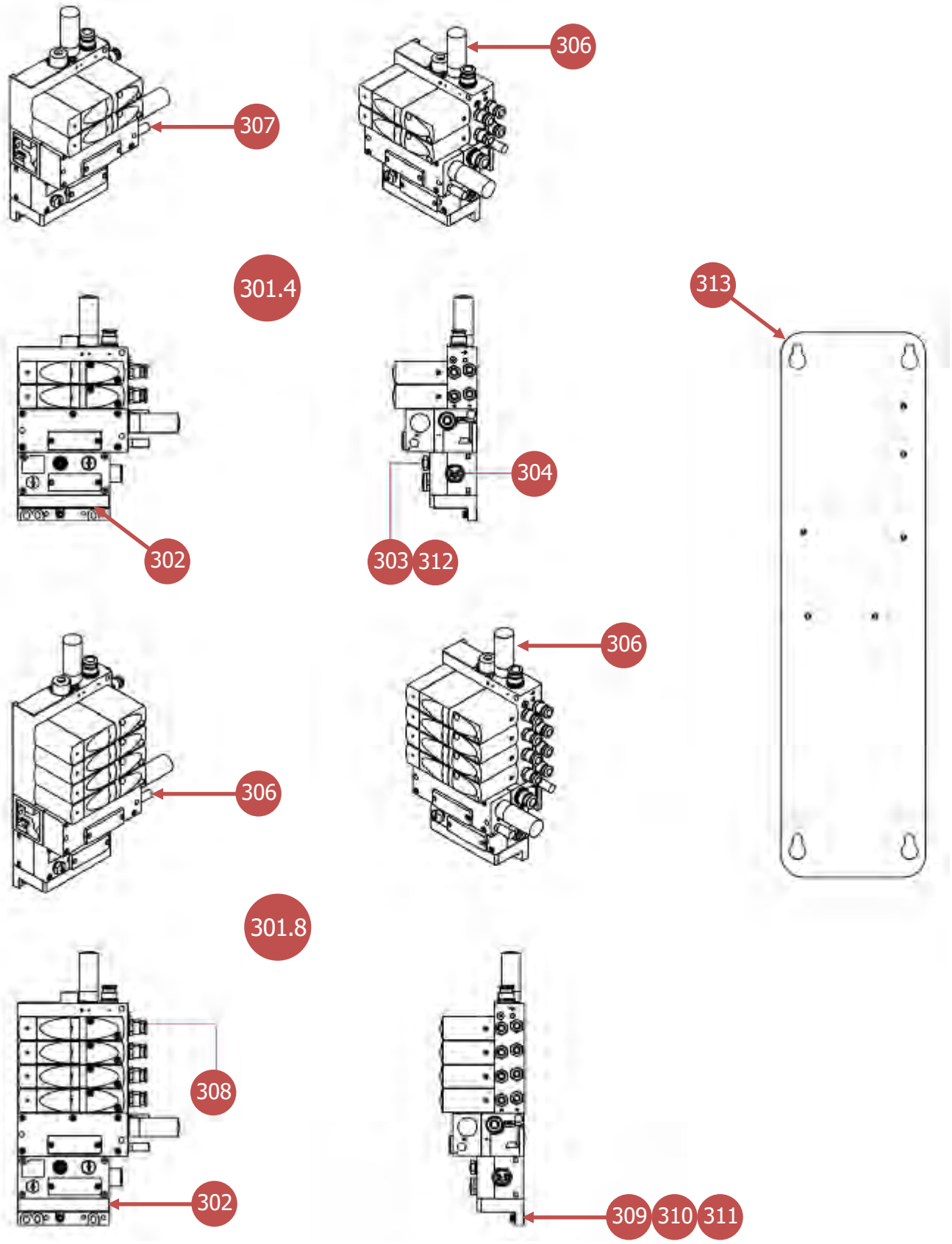
| OUTER ENCLOSURE | | | |
|---|---|---|---|
| **Item** | **Qty** | **Part No.** | **Description** |
| 101 | 1 | - | Control Enclosure Door Frame |
| 102 | 1 | - | Control Enclosure Thermoform |
| 103 | 1 | - | Slotted Door Latch |
| 104 | 1 | - | E-Stop Decal |
| 105 | 1 | 310-4127 | USB WATERPROOF COVER |
| 106 | 1 | 310-4128 | CABLE, USB, PANEL MOUNT, 1M CABLE |
| 107 | 4 | 310-4129 | ETHERNET BULKHEAD, RJ45 FEMALE TO FEMALE |
| 108 | 6 | - | CONNECTOR, BULKHEAD, M12, 5PIN, FEMALE TO LEAD, 1M |
| 109 | 1 | - | BULKHEAD CONNECTOR, 7/8" 5 POLE, FEMALE TO LEAD |
| 110 | 1 | - | LIGHT INDICATOR W/ HORN, 7 COLOR, 10-30VDC, |
| 111 | 1 | 240-5159 | LOAD SWITCH, 16A, FRONT/DOOR, W/ ACTUATOR |
| 112 | 1 | EX715-CARLISLE | HMI, EX SERIES, 15", W/ CODESYS |
| 113 | 1 | - | SD CARD, 32GB, CDW P/N 3052120, MFG P/N SDSDB-032G-A46 |
| 114 | 1 | 240-5166 | Non-Illuminated Mushroom Operators, Twist to Release, 40 mm, |
| 115 | 1 | 240-5167 | 800F Latch, Plastic Latch, Standard Pack |
| 116 | 2 | 310-4103 | 22.5mm PB No Latch, Screw Contact Block, 1 N.C. Self-monitoring |
| 117 | 4 | - | FERRITE (EMI TOROID 12.2OD x 7x1ID x 12.7MM) |

## CONTROL BACKPANEL



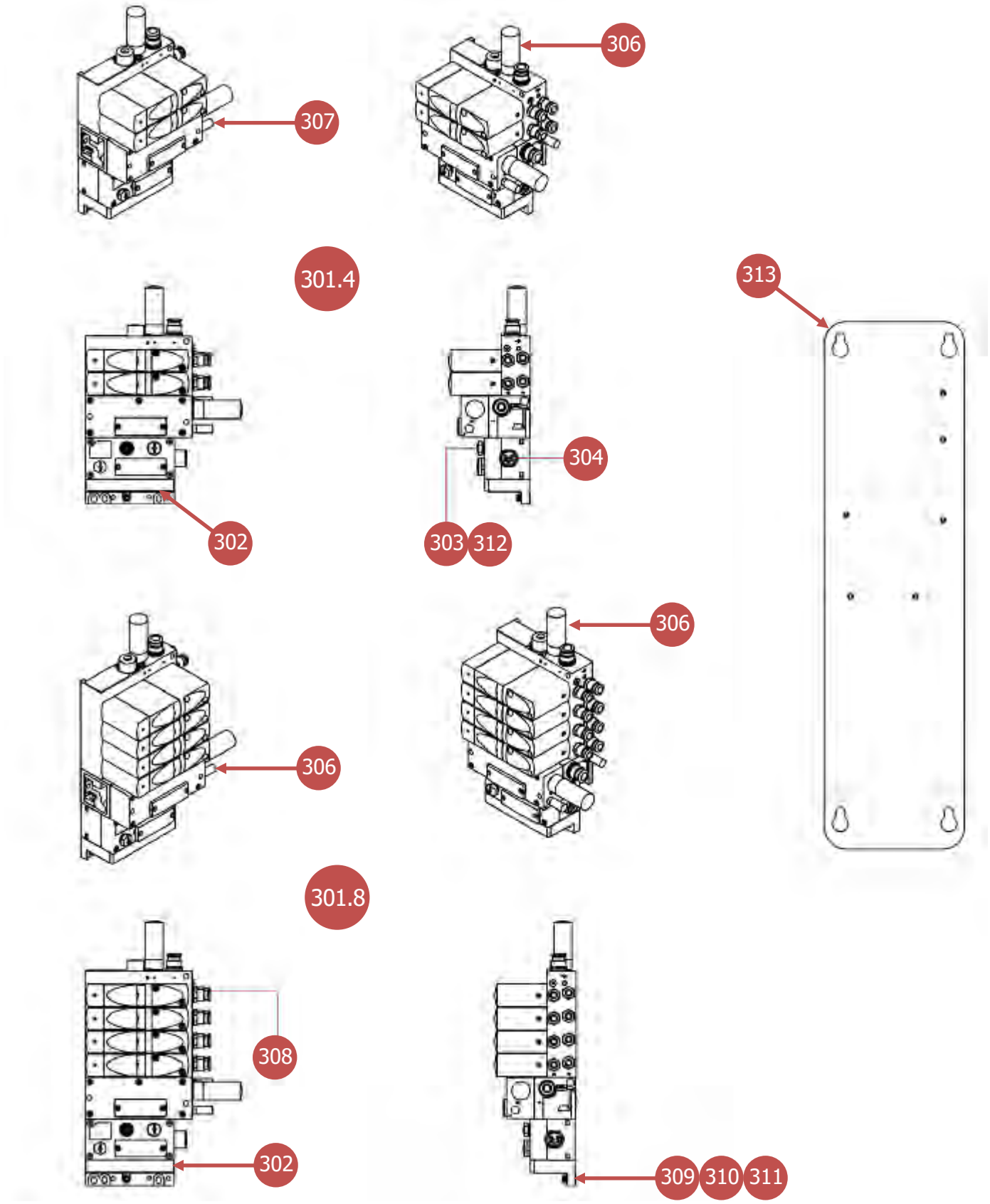
| CONTROL BACKPANEL | | | |
|---|---|---|---|
| **Item** | **QTY** | **Part No.** | **Description** |
| 201 | 1 | - | Electronics Back Panel |
| 202 | 1 | 310-4116 | SAFETY RELAY |
| 203 | 1 | 310-4104 | ELEC CIRC PROT, 4CH, CLASS 2 |
| 204 | 1 | 310-4105 | ETH SWITCH, UNMANAGED, 8PRT |
| 205 | 1 | - | PLC, 2MB |
| 206 | 1 | - | TERMINAL, SCREW, KIT, 5069 CPU |
| 207 | 1 | 310-4147 | POWER SUPPLY, 24VDC, 240W, 10A |
| 208 | 1 | 240-5176 | CIRC. BREAKER, 2 POLE, 5A |
| 209 | 19 | - | BOLT, MOUNTING |
| 210 | 1 | 310-4126 | LINE FILTER, 6A, 2STAGE |
| 211 | 41 | - | TERMINAL BLOCK |
| | 5 | - | GROUND TERMINAL BLOCK |
| | 2 | - | TERMINAL BLOCK END |
| | 3 | - | TERMINAL BLOCK END - YELLOW |
| | 1 | - | JUMPER 2-pole |
| | 1 | - | JUMPER 4-pole |
| | 1 | - | JUMPER 6-pole |
| | 12 | - | END RETAINER |
| 212 | 1 | 310-4115 | REMOTE I/O, ADAPTER, ETHERNET |
| 213 | 3 | 310-4111 | REMOTE I/O, 16 PT. DIG. INPUT |
| 214 | 1 | 310-4112 | REMOTE I/O, 16 PT. DIG. OUTPUT |
| 215 | 1 | 310-4114 | REMOTE I/O, 8 CH. ANLG INPUT |
| 216 | 2 | 310-4113 | REMOTE I/O, 2 CH HIGH SPEED IN |
| 217 | - | - | - |
| 218 | 4 | - | SPACER FOR BACK PANEL |
| 219 | 1 | - | GROUND STRAP FOR BACK PANEL |
| 220 | 4 | 310-4134 | CABLE,ETHERNET,5FT |
| 221 | 4 | 310-4135 | CABLE, ETHERNET, 3FT |
| 222 | 4 ft | - | Panduit 1 x 4", Gray |
| 223 | 4 ft | - | Panduit Cover, 1" Gray |
| 224 | 3 ft | - | DIN Rail, Perforated |

## PRESSURE REGULATOR MODULES



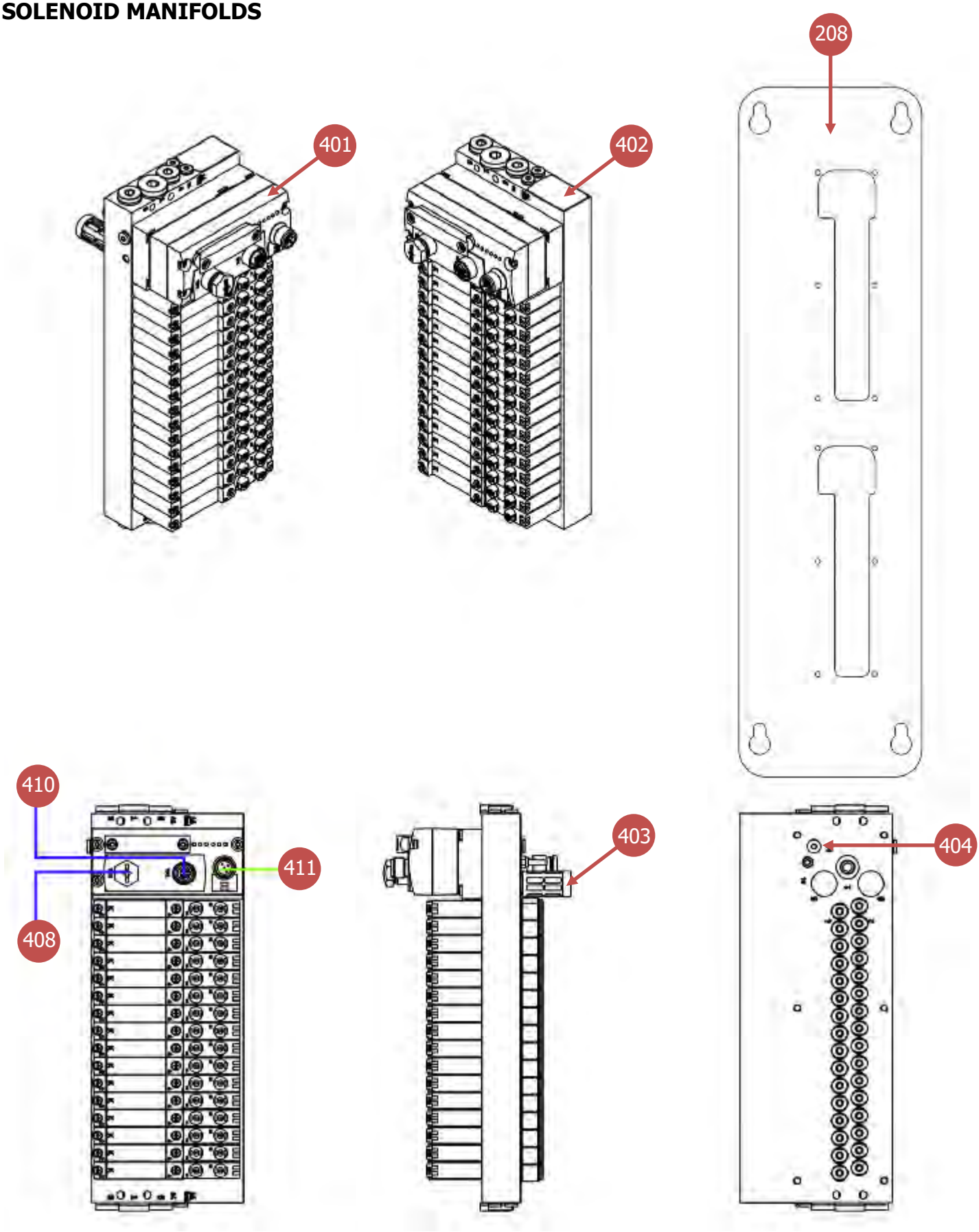
| PRESSURE REGULATOR MODULES | | | | |
|---|---|---|---|---|
| **Code-Top Level Column C** | **Item** | **QTY** | **Part No** | **Description** |
| 0 | | - | - | - |
| 2 | 301.4 | 1 | 310-3910 | PRESSURE MANIFOLD ASSEMBLY, 4 REGULATORS (VTEM-S1-27-E1-B1-Q10-U-Q6-CC-BAP-2PD) |
| | 302 | Included w/ manifold | - | COMM MODULE, FOR FESTO VTEM REGULATORS (50E-F36GCQP-P) |
| | 303 | 1 | 310-4136 | CBL, ETHERNET, RJ45-M12-90, 1M |
| | 304 | 1 | 310-4140 | CBL, MINI (7/8”), 5P, 2M, F-M |
| | 305 | Included w/ 310-3911 | UC-3/8 | Pneumatic muffler (comes with 310-3911) |
| | 306 | 1 | 20-7023 | G3/8 - 3/8” Tube VTEM inlet |
| | 307 | 2 | 20-7024 | G1/8 - 1/4” Tube VTEM to MVR |
| | 308 | 16 | 20-7022 | G1/8 - 4 mm Tube VTEM to HGB |
| | 309 | 6 | 20-7028 | VTUG Mounting Bolts |
| | 310 | 6 | 20-7026 | VTUG Mounting Washers |
| | 311 | 6 | 20-7027 | VTUG Mounting ToothWashers |
| | 313 | 1 | 310-2801 | VTEM Mounting Bracket |
| 4 | 301.8 | 1 | 310-3911 | PRESSURE MANIFOLD ASSEMBLY, 8 REGULATORS (VTEM-S1-27-E1-B1-Q10-U-Q6-4C-BAP-4PD) |
| | 302 | Included w/ manifold | - | COMM MODULE, FOR FESTO VTEM REGULATORS (50E-F36GCQP-P) |
| | 303 | 1 | 310-4136 | CBL, ETHERNET, RJ45-M12-90, 1M |
| | 304 | 1 | 310-4140 | CBL, MINI (7/8), 5P, 2M, F-M |
| | 305 | Included w/ manifold | UC-3/8 | Pneumatic muffler (comes with 310-3911) |
| | 306 | 1 | 20-7023 | G3/8 - 3/8” Tube VTEM inlet |
| | 307 | 2 | 20-7024 | G1/8 - 1/4” Tube VTEM to MVR |
| | 308 | 16 | 20-7022 | G1/8 - 4 mm Tube VTEM to HGB |
| | 309 | 6 | 20-7028 | VTUG Mounting Bolts |
| | 310 | 6 | 20-7026 | VTUG Mounting Washers |
| | 311 | 6 | 20-7027 | VTUG Mounting ToothWashers |
| | 313 | 1 | 310-2801 | VTEM Mounting Bracket |

## PRESSURE REGULATOR MODULES (cont.)



| PRESSURE REGULATOR MODULES (cont.) | | | | |
|---|---|---|---|---|
| **Code-Top Level Column C** | **Item** | **QTY** | **Part No** | **Description** |
| 6 | 301.4 | 1 | 310-3910 | PRESSURE MANIFOLD ASSEMBLY, 4 REGULATORS (VTEM-S1-27-E1-B1-Q10-U-Q6-CC-BAP-2PD) |
| | 301.8 | 1 | 310-3911 | PRESSURE MANIFOLD ASSEMBLY, 8 REGULATORS (VTEM-S1-27-E1-B1-Q10-U-Q6-4C-BAP-4PD) |
| | 302 | incl. w/ manifold | | COMM MODULE, FOR FESTO VTEM REGULATORS (50E-F36GCQP-P) |
| | 303 | 1 | 310-4136 | CBL, ETHERNET, RJ45-M12-90, 1M |
| | 304 | 2 | 310-4140 | CBL, MINI (7/8”), 5P, 2M, F-M |
| | 305 | incl. w/ manifold | UC-3/8 | Pneumatic muffler (comes with 310-3911) |
| | 306 | 2 | 20-7023 | G3/8 - 3/8” Tube VTEM inlet |
| | 307 | 3 | 20-7024 | G1/8 - 1/4” Tube VTEM to MVR |
| | 308 | 32 | 20-7022 | G1/8 - 4 mm Tube VTEM to HGB |
| | 309 | 12 | 20-7028 | VTUG Mounting Bolts |
| | 310 | 12 | 20-7026 | VTUG Mounting Washers |
| | 311 | 12 | 20-7027 | VTUG Mounting ToothWashers |
| | 312 | 1 | 310-4133 | CABLE, CAT 5E, M12, 1M |
| | 313 | 2 | 310-2801 | VTEM Mounting Bracket |
| 8 | 301.8 | 2 | 310-3911 | PRESSURE MANIFOLD ASSEMBLY, 8 REGULATORS (VTEM-S1-27-E1-B1-Q10-U-Q6-4C-BAP-4PD) |
| | 302 | incl. w/ manifold | | COMM MODULE, FOR FESTO VTEM REGULATORS (50E-F36GCQP-P) |
| | 303 | 1 | 310-4136 | CBL, ETHERNET, RJ45-M12-90, 1M |
| | 304 | 2 | 310-4140 | CBL, MINI (7/8”), 5P, 2M, F-M |
| | 305 | incl. w/ manifold | UC-3/8 | Pneumatic muffler (comes with 310-3911) |
| | 306 | 2 | 20-7023 | G3/8 - 3/8” Tube VTEM inlet |
| | 307 | 3 | 20-7024 | G1/8 - 1/4” Tube VTEM to MVR |
| | 308 | 32 | 20-7022 | G1/8 - 4 mm Tube VTEM to HGB |
| | 309 | 12 | 20-7028 | VTUG Mounting Bolts |
| | 310 | 12 | 20-7026 | VTUG Mounting Washers |
| | 311 | 12 | 20-7027 | VTUG Mounting ToothWashers |
| | 312 | 1 | 310-4133 | CABLE, CAT 5E, M12, 1M |
| | 313 | 2 | 310-2801 | VTEM Mounting Bracket |

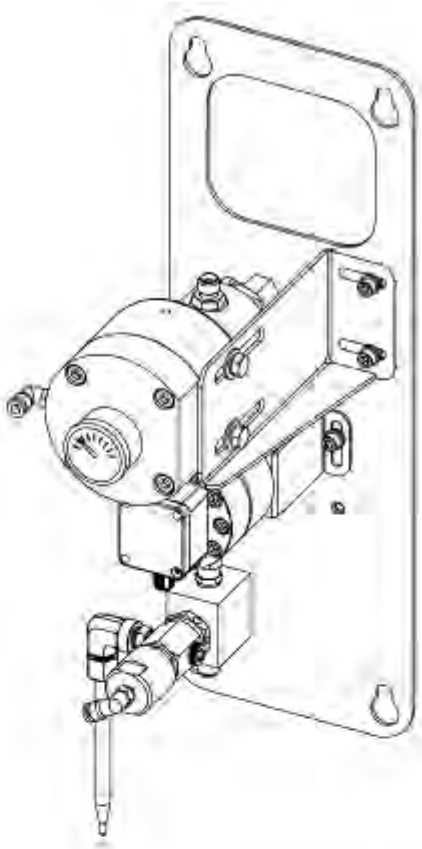
## SOLENOID MANIFOLDS

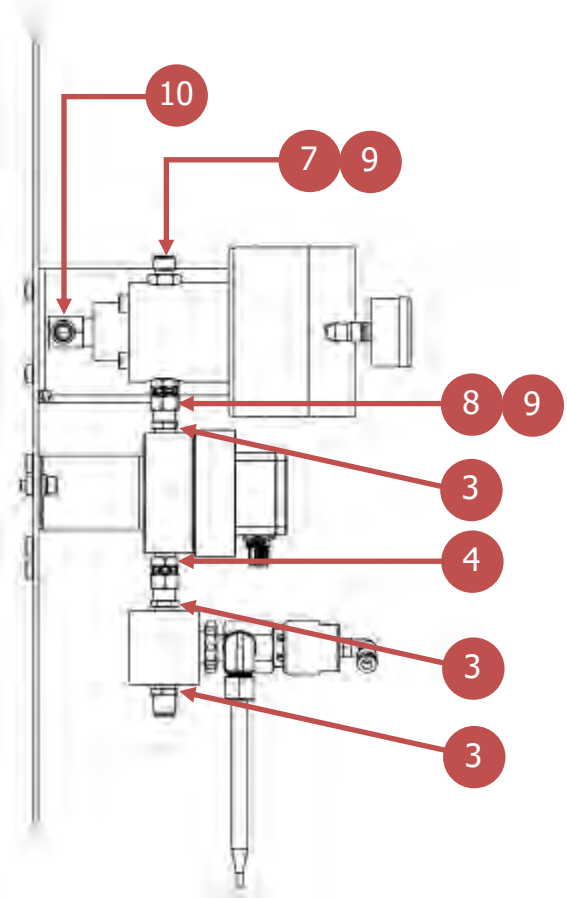


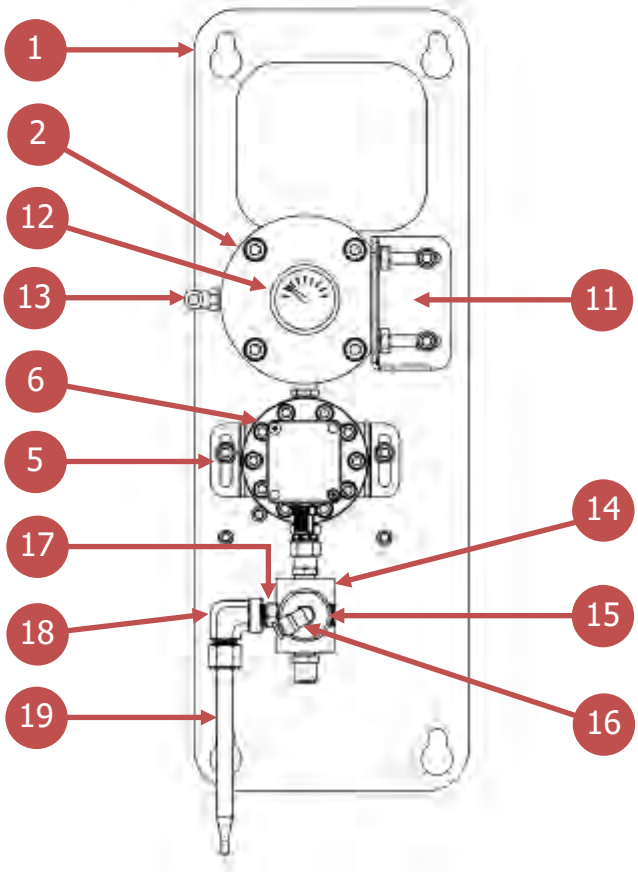
| SOLENOID MANIFOLDS | | | | | | |
|---|---|---|---|---|---|---|
| **Item** | **QTY** | | | | **Part No.** | **Description** |
| - | **E=1** | **E=2** | **E=3** | **E=4** | - | - |
| 401 | 1 | 2 | 3 | 4 | 310-3921 | VALVE COMM MODULE, EIP |
| 402 | 1 | 2 | 3 | 4 | 310-3920 | VALVE, PNEUMATIC MANIFOLD 16PORT-16 DUAL SOLENOIDS (VTUG-10-VRPT-B1T-T516B-UB-QH4SU-16K) |
| 403 | 1 | 2 | 3 | 4 | UC-3/8 | Pneumatic muffler (comes with 310-3920) |
| 404 | 2 | 4 | 6 | 8 | 20-7022 | G1/8 - 4 mm Tube |
| 405 | 4 | 8 | 12 | 16 | 20-7028 | VTUG Mounting Bolts (M4 20 mm) |
| 406 | 4 | 8 | 12 | 16 | 20-7026 | VTUG Mounting Washers |
| 407 | 4 | 8 | 12 | 16 | 20-7027 | VTUG Mounting ToothWashers |
| 408 | 0 | 1 | 2 | 3 | 310-4133 | CABLE, CAT 5E, M12, 1M |
| 409 | 1 | 1 | 1 | 1 | 310-4136 | CBL, ETHERNET, RJ45-M12-90, 1M |
| 410 | 1 | 2 | 3 | 4 | 310-4148 | CBL, M12, 5PIN, 0.3M, 0-90DEG |
| 411 | 1 | 2 | 3 | 4 | 310-2800 | VTUG Mounting Bracket |

## FLUID MODULE

WEEPING
(See manual No. LN-9112-00 for additional details)



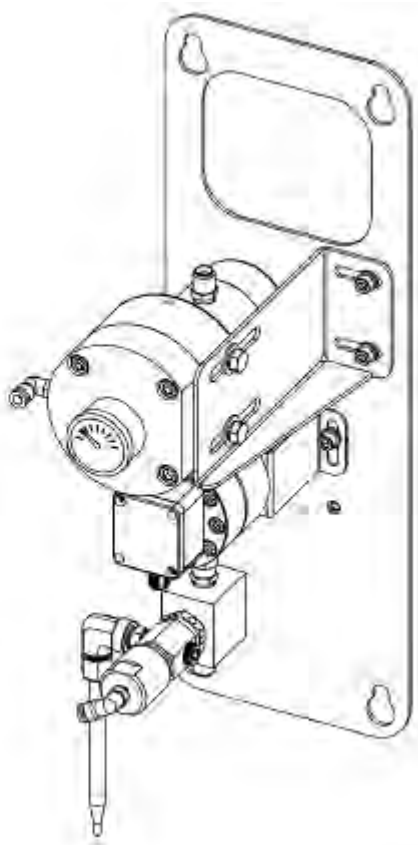


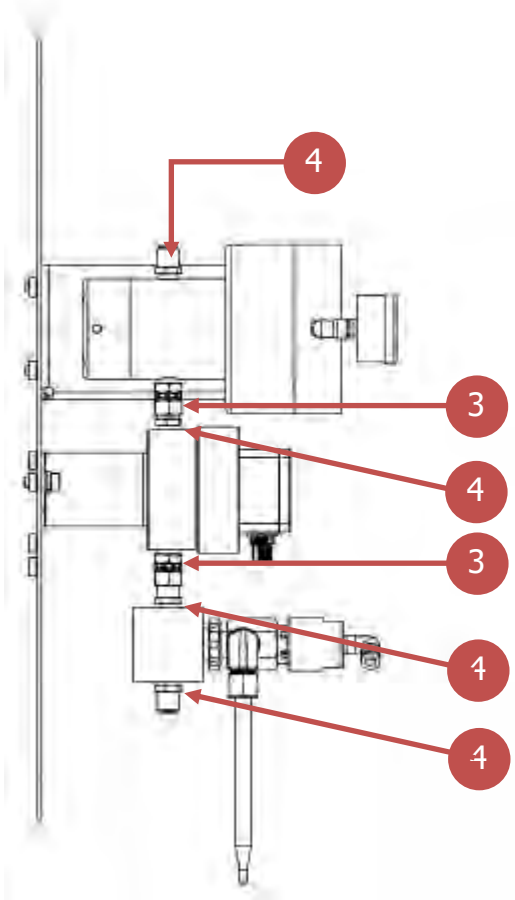



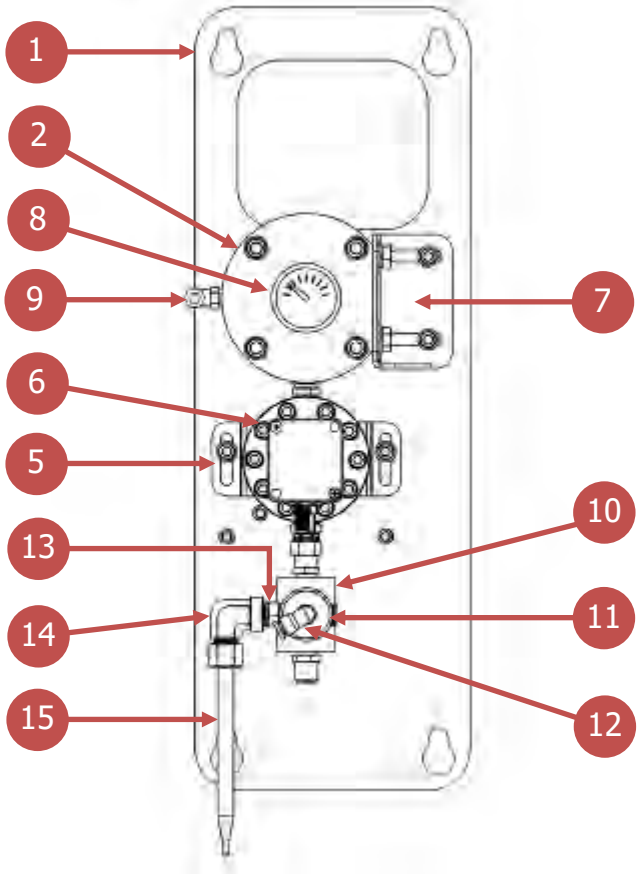
| FLUID MODULE-WEEPING | | | |
|---|---|---|---|
| **Item** | **QTY** | **Part No.** | **Description** |
| 1 | 1 | 310-3301 | FLUID CONTROL PANEL |
| 2 | - | TR-SSMM-147 | 02 WEEPING MVR |
| 2 | - | TR-SSMM-148 | 03 WEEPING MVR |
| 2 | - | TR-SSMM-225 | 04 WEEPING MVR |
| 3 | 3 | 4-6JIC | FITTING, 1/4” NPS (M) x 3/8” JIC (F) |
| 4 | 1 | 4SN-6JIC | FITTING, 1/4” NPS (F) x 3/8” JIC (M) |
| 5 | 1 | 310-2806 | MOUNTING BRACKET |
| 6 | - | 310-9000 | GEAR FLOW METER, DUAL PROBE |
| 6 | - | 310-9001 | GEAR FLOW METER, FIBER OPTIC |
| 6 | - | A13296 | PISTON FLOW METER |
| 7 | 1 | 4-6B | FITTING, 1/4” NPS (M) x 3/8” NPS (M) |
| 8 | 1 | 4SN-6B | FITTING, 1/4” NPS (M) x 3/8” NPS (M) |
| 9 | 2 | TR-110952 | SEAL |
| 10 | 1 | 6T-4-90 | FITTING, ELBOW, 3/8” NPS (M) x 1/4” NPS (M) |
| 11 | 1 | 310-2802 | MVR MOUNTING BRACKET |
| 12 | 1 | GA-338 | 1/8” NPT BACK MOUNT GAUGE (0-160 PSI), 1 1/2” DIA |
| 13 | 1 | JML-14-2T | ELBOW 1/8” NPT (M) x 1/4” ODT |
| 14 | 1 | 310-8200 | CALIBRATION BLOCK |
| 15 | 1 | CCV-503-SS | CCV VALVE |
| 16 | 1 | JML-532-2T | ELBOW 1/8” NPT (M) x 1/4” ODT |
| 17 | 1 | 4T-4T | FITTING, 1/4” NPT (M) x 1/4” NPT (M) |
| 18 | 1 | SSP-6443 | FITTING, ELBOW, 1/4” NPT (M) x 3/8” ODT |
| 19 | 1 | LSMM0059-01 | CALIBRATION TUBE |

## FLUID MODULE

WEEPLESS
(See manual No. LN-9225-00 for additional details)



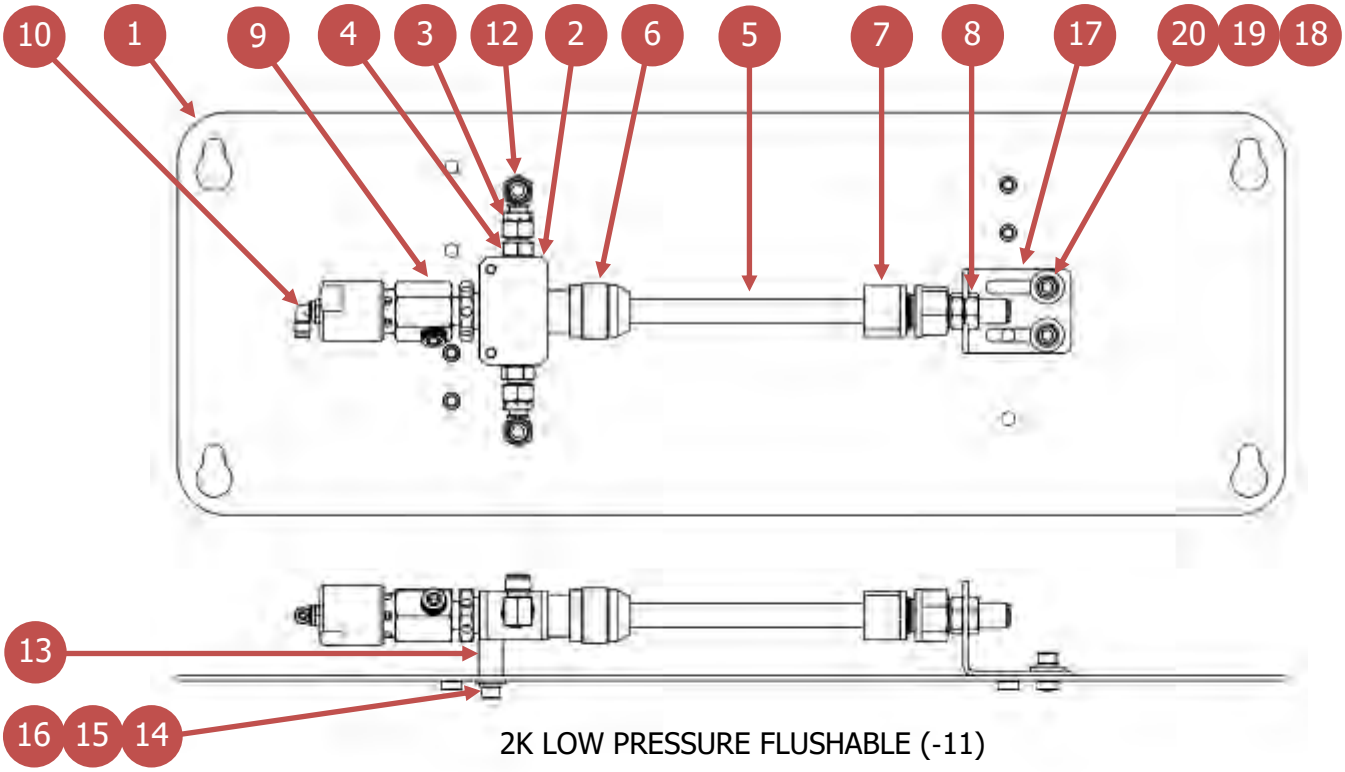


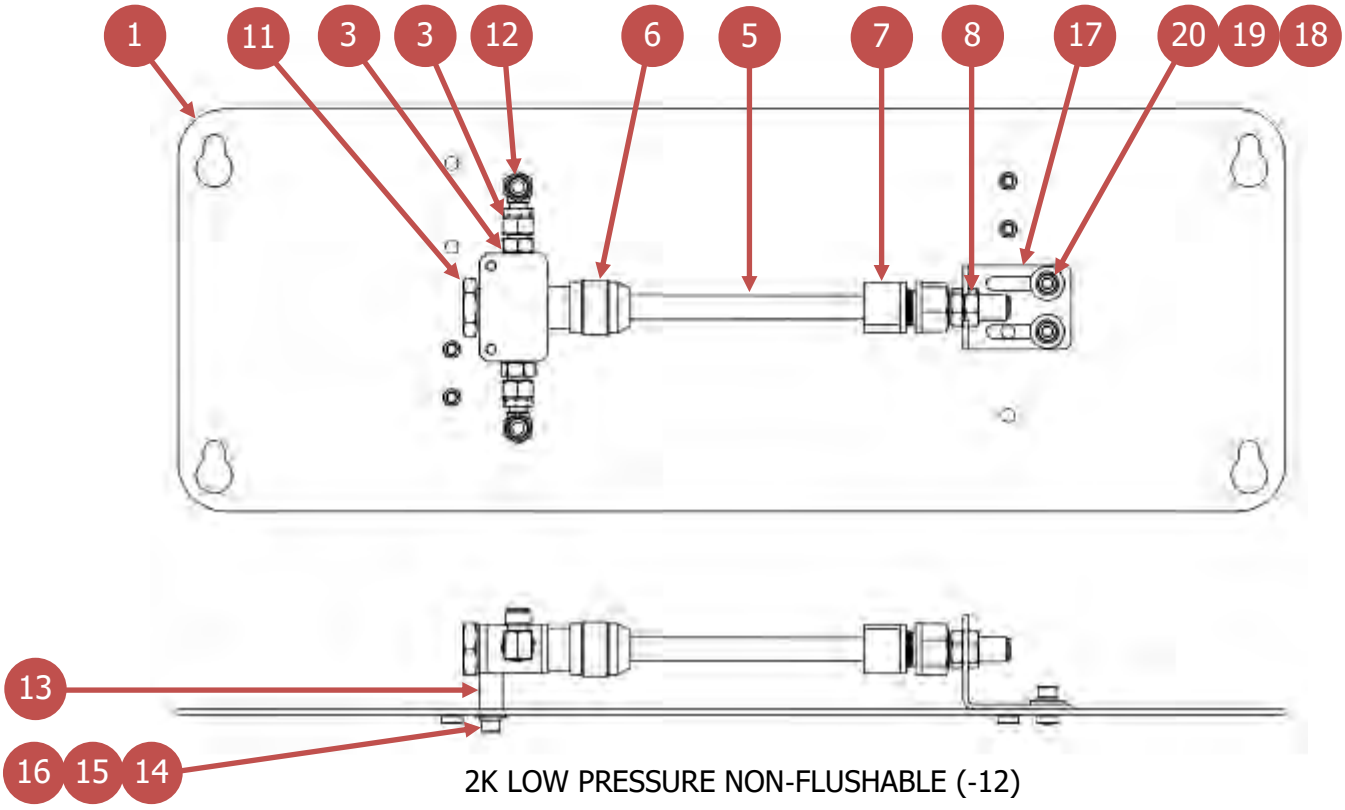
| FLUID MODULE-WEEPLESS | | | |
|---|---|---|---|
| **Item** | **QTY** | **Part No.** | **Description** |
| 1 | 1 | 310-3301 | FLUID CONTROL PANEL |
| 2 | - | 76624-02 | 02 WEEPING MVR |
| 2 | - | 76624-03 | 03 WEEPING MVR |
| 2 | - | 76624-04 | 04 WEEPING MVR |
| 3 | 1 | 4SN-6JIC | FITTING, 1/4” NPS (F) x 3/8” JIC (F) |
| 4 | 4 | 4-6JIC | FITTING, 1/4” NPS (M) x 3/8” JIC (M) |
| 5 | 1 | 310-2806 | MOUNTING BRACKET |
| 6 | - | 310-9000 | GEAR FLOW METER, DUAL PROBE |
| 6 | - | 310-9001 | GEAR FLOW METER, FIBER OPTIC |
| 6 | - | A13296 | PISTON FLOW METER |
| 7 | 1 | 310-2802 | MVR MOUNTING BRACKET |
| 8 | 1 | GA-338 | 1/8” NPT BACK MOUNT GAUGE (0-160 PSI), 1 1/2” DIA |
| 9 | 1 | JML-14-2T | ELBOW 1/8” NPT (M) x 1/4” ODT |
| 10 | 1 | 310-8200 | CALIBRATION BLOCK |
| 11 | 1 | CCV-503-SS | CCV VALVE |
| 12 | 1 | JML-532-2T | ELBOW 1/8” NPT (M) x 1/4” ODT |
| 13 | 1 | 4T-4T | FITTING, 1/4” NPT (M) x 1/4” NPT (M) |
| 14 | 1 | SSP-6443 | FITTING, ELBOW, 1/4” NPT (M) x 3/8” ODT |
| 15 | 1 | LSMM0059-01 | CALIBRATION TUBE |

**FLUID MIX PANEL**

2K Low Pressure: Flushable/Non-Flushable




2K LOW PRESSURE FLUSHABLE (-11)

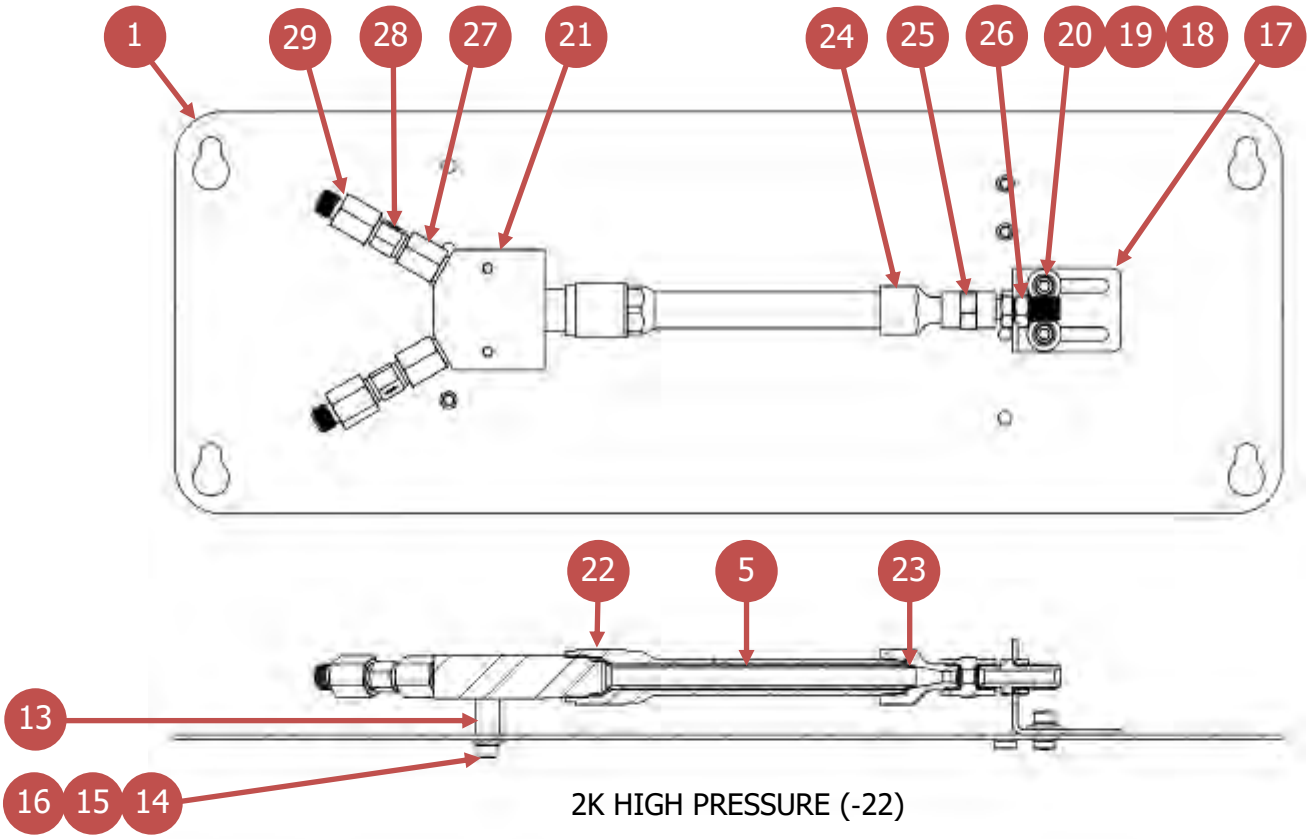



2K LOW PRESSURE NON-FLUSHABLE (-12)

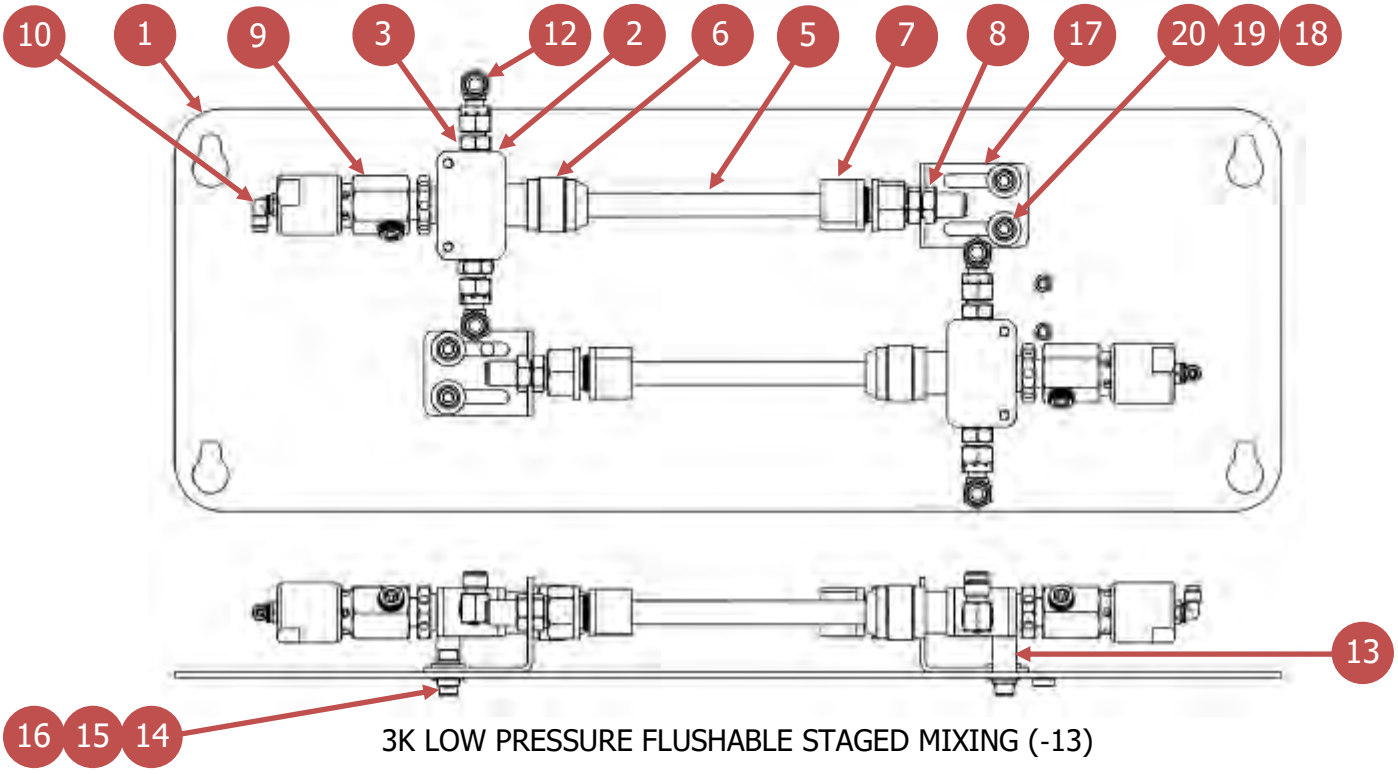
| FLUID MIX PANEL-2K LOW PRESSURE: FLUSHABLE/NON-FLUSHABLE | | | | | | |
|---|---|---|---|---|---|---|
| **Item** | **Part No.** | **Description** | **2K Low Pressure Flushable (-11)** | **2K Low Pressure Non-Flushable (-11)** | **3K Low Pressure Flushable (-13)** | **2K High Pressure (-22)** |
| 1 | 310-3807 | FLUID MIX PANEL WELDMENT | 1 | 1 | 1 | 1 |
| 2 | 78015 | 2K MIX BLOCK | 1 | 1 | 2 | - |
| 3 | 22-280 | CHECK VALVE ASSEMBLY | 2 | 2 | 4 | - |
| 4 | 22-285 | SEAL | 2 | 2 | 4 | - |
| 5 | LSMM0056-00 | 3/8" ID x 18 ELEMENT MIXER | 1 | 1 | 2 | 1 |
| 6 | LSMM0057-00 | MIX TUBE RETAINING KIT | 1 | 1 | 2 | - |
| 7 | 20-7047 | FITTING, 1/2" ODT x 3/8" NPT (F), ACETAL | 1 | 1 | 2 | - |
| 8 | 6T-4RB | FITTING, 3/9" NPT (M) x 1/4" NPS (M), BULKHEAD | 1 | 1 | 2 | - |
| 9 | CCV-503-SS | VALVE ASSEMBLY | 1 | - | 2 | - |
| 10 | 41-FTP-1006 | 1/8" NPT (M) x 5/32" TUBE ELBOW | 1 | - | 2 | - |
| 11 | KK-4370 | PLUG KIT | - | 1 | - | - |
| 12 | 4SN-4-90 | FITTING, ELBOW, 1/4" NPS (M) x 1/4" NPS (F) | 2 | 2 | 4 | - |
| 13 | 20-7016 | SPACER, 1/2" OD, 1/4" ID, 3/4" LG | 2 | 2 | 4 | 2 |
| 14 | - | SHCS, 1/4"-20, 1-7/8" LG, 18-8 | 2 | 2 | 4 | 2 |
| 15 | - | WASHER, LOCK, 1/4", 18-8 | 2 | 2 | 4 | 2 |
| 16 | - | WASHER, FLT, 1/4", 18-8 | 2 | 2 | 4 | 2 |
| 17 | 310-3808 | MIXER MOUNT BRACKET | 1 | 1 | 2 | 1 |
| 18 | - | WASHER, M6, 18-8 | 2 | 2 | 4 | 2 |
| 19 | - | WASHER, LOCK, 18-8 | 2 | 2 | 4 | 2 |
| 20 | - | SHCS, M6 x 1, 14MM LG, 18-8 | 2 | 2 | 4 | 2 |

**FLUID MIX PANEL**

2K High Pressure & 3K Low Pressure: Flushable Staged Mixing




2K HIGH PRESSURE (-22)




3K LOW PRESSURE FLUSHABLE STAGED MIXING (-13)

| FLUID MIX PANEL-2K LOW PRESSURE (FLUSHABLE/NON-FLUSHABLE) | | | | | | |
|---|---|---|---|---|---|---|
| **Item** | **Part No.** | **Description** | **2K Low Pressure Flushable (-11)** | **2K Low Pressure Non-Flushable (-11)** | **3K Low Pressure Flushable (-13)** | **2K High Pressure (-22)** |
| 1 | 310-3807 | FLUID MIX PANEL WELDMENT | 1 | 1 | 1 | 1 |
| 2 | 78015 | 2K MIX BLOCK | 1 | 1 | 2 | - |
| 3 | 22-280 | CHECK VALVE ASSEMBLY | 2 | 2 | 4 | - |
| 4 | 22-285 | SEAL | 2 | 2 | 4 | - |
| 5 | LSMM0056-00 | 3/8" ID x 18 ELEMENT MIXER | 1 | 1 | 2 | 1 |
| 6 | LSMM0057-00 | MIX TUBE RETAINING KIT | 1 | 1 | 2 | - |
| 7 | 20-7047 | FITTING, 1/2" ODT x 3/8" NPT (F), ACETAL | 1 | 1 | 2 | - |
| 8 | 6T-4RB | FITTING, 3/9" NPT (M) x 1/4" NPS (M), BULKHEAD | 1 | 1 | 2 | - |
| 9 | CCV-503-SS | VALVE ASSEMBLY | 1 | - | 2 | - |
| 10 | 41-FTP-1006 | 1/8" NPT (M) x 5/32" TUBE ELBOW | 1 | - | 2 | - |
| 11 | KK-4370 | PLUG KIT | - | 1 | - | - |
| 12 | 4SN-4-90 | FITTING, ELBOW, 1/4" NPS (M) x 1/4" NPS (F) | 2 | 2 | 4 | - |
| 13 | 20-7016 | SPACER, 1/2" OD, 1/4" ID, 3/4" LG | 2 | 2 | 4 | 2 |
| 14 | - | SHCS, 1/4"-20, 1-7/8" LG, 18-8 | 2 | 2 | 4 | 2 |
| 15 | - | WASHER, LOCK, 1/4", 18-8 | 2 | 2 | 4 | 2 |
| 16 | - | WASHER, FLT, 1/4", 18-8 | 2 | 2 | 4 | 2 |
| 17 | 310-3808 | MIXER MOUNT BRACKET | 1 | 1 | 2 | 1 |
| 18 | - | WASHER, M6, 18-8 | 2 | 2 | 4 | 2 |
| 19 | - | WASHER, LOCK, 18-8 | 2 | 2 | 4 | 2 |
| 20 | - | SHCS, M6 x 1, 14MM LG, 18-8 | 2 | 2 | 4 | 2 |
| 21 | LBAL0016-00 | "Y"-BLOCK, 2K | - | - | - | 1 |
| 22 | LBAL0022-00 | JACKET, HIGH PRESSURE, FOR DISPOSABLE MIXER | - | - | - | 1 |
| 23 | - | | - | - | - | 1 |
| 24 | LBAL0023-00 | ADAPTER, FLUID HOSE, HIGH PRESSURE | - | - | - | 1 |
| 25 | 240-3133 | FITTING, 1/4" NPT (M) x 1/4" NPT (F) | - | - | - | 1 |
| 26 | 4T-4RB | FITTING, 1/4" NPT (M) x 1/4" NPS (M), BULKHEAD | - | - | - | 1 |
| 27 | 6GTX | FITTING, 1/4" NPT (F) x 3/8" JIC (M) | - | - | - | 2 |
| 28 | SSV-809 | CHECK VALVE | - | - | - | 2 |
| 29 | 4-4T (F) | FITTING, 1/4" NPS (M) x 1/4" NPT (F) | - | - | - | 2 |

## REPAIR KITS (WEAR ITEMS)

| REPAIR KITS (WEAR ITEMS) | | | | | | |
|---|---|---|---|---|---|---|
| **PN** | **Description** | **Category** | **Auto LP qty.** | **MAN LP qty.** | **Auto HP qty.** | **MAN HP qty.** |
| KK-4841 | CCV Repair Kit, LP | Fluid Panel | 5 | 5 | 0 | 0 |
| 240-2048 | HP CCV Seal Kit, Internal | Fluid Panel | 0 | 0 | 5 | 5 |
| 240-2048 | HP CCV Seal Kit, External | Fluid Panel | 0 | 0 | 5 | 5 |
| 310-9017-K5 | Flow meter Seal Kit, 5 Pack | Fluid Panel | 1 | 1 | 1 | 1 |
| 77052-00 | MVR Repair Kit, Weepless | Fluid Panel | 2 | 0 | 2 | 0 |
| TR-SSMM-151 | Air Diaphragm, MVR Assembly (Weeping Only) | Fluid Panel | 3 | 0 | 0 | 0 |
| 78783-00 | Compression Spring, MVR (Weeping Only) | Fluid Panel | 1 | 0 | 0 | 0 |
| SSG-8125 | O-Ring, PTFE (Weeping Only) | Fluid Panel | 1 | 0 | 0 | 0 |
| 76623-02 | #2 MVR Needle, Weepless | Fluid Panel | A/R | 0 | A/R | 0 |
| 76623-03 | #3 MVR Needle, Weepless | Fluid Panel | A/R | 0 | A/R | 0 |
| 76623-04 | #4 MVR Needle, Weepless | Fluid Panel | A/R | 0 | A/R | 0 |
| TR-SSMM-149 | #2 MVR Needle, Weeping | Fluid Panel | A/R | 0 | 0 | 0 |
| TR-SSMM-150 | #3 MVR Needle, Weeping | Fluid Panel | A/R | 0 | 0 | 0 |
| TR-SSMM-226 | #4 MVR Needle, Weeping | Fluid Panel | A/R | 0 | 0 | 0 |
| 22-280 | Check Valve | Fluid Panel | 4 | 4 | 2 | 2 |
| SSV-809 | Check Valve | Fluid Panel | 2 | 2 | 4 | 4 |
| 240-2062 | Pulse Valve Repair Kit | Fluid Panel | 0 | 2 | 0 | 2 |
| 6-1306 | Repair Kit, HP Fluid Regulator, Manually-Operated | Fluid Panel | 0 | 0 | 2 | 2 |
| LSMM0056-00 | Static Mixer | Fluid Panel | 2 | 2 | 2 | 2 |
| 310-3915 | Pressure Regulator, Individual Replacement | Fluid Panel | 1 | 1 | 0 | 0 |
| 310-3925 | Solenoid Valve, Individual Replacement | Controller | 2 | 2 | 2 | 2 |

## SPARE ASSEMBLIES (RECOMMENDED)

| SPARE ASSEMBLIES (RECOMMENDED) | | | | | | |
|---|---|---|---|---|---|---|
| **PN** | **Description** | **Category** | **Auto LP qty.** | **MAN LP qty.** | **Auto HP qty.** | **MAN HP qty.** |
| CCV-503-SS | CCV Valve, LP | Fluid Panel | 2 | 2 | 0 | 0 |
| 240-2012 | CCV Valve, HP | Fluid Panel | 0 | 0 | 2 | 2 |
| 310-9010 | Flow meter Body | Fluid Panel | 1 | 1 | 1 | 1 |
| 310-9011 | Flow meter Dual Probe Pickup | Fluid Panel | 1 | 1 | 1 | 1 |
| 240-2061 | Pulse Valve Assembly | Fluid Panel | 0 | 1 | 0 | 1 |
| HGB-510-R1-CO | HGB Fluid Regulator, Air-Piloted | Fluid Panel | 1 | 0 | 0 | 0 |
| HGB-609-9-R38 | HGB Fluid Regulator, Manually-Operated | Fluid Panel | 0 | 1 | 0 | 0 |
| 84-420 | Manual Fluid Regulator, HP | Fluid Panel | 0 | 0 | 1 | 1 |
| 76624-02 | MVR Assembly, #2 Weepless | Fluid Panel | A/R | 0 | A/R | 0 |
| 76624-03 | MVR Assembly, #3 Weepless | Fluid Panel | A/R | 0 | A/R | 0 |
| 76624-04 | MVR Assembly, #4 Weepless | Fluid Panel | A/R | 0 | A/R | 0 |
| TR-SSMM-147 | MVR Assembly, #2 Weeping | Fluid Panel | A/R | 0 | 0 | 0 |
| TR-SSMM-148 | MVR Assembly, #3 Weeping | Fluid Panel | A/R | 0 | 0 | 0 |
| TR-SSMM-225 | MVR Assembly, #4 Weeping | Fluid Panel | A/R | 0 | 0 | 0 |
| 78015-00 | Mix Manifold Assembly, LP, With Solvent Flush | Fluid Panel | 1 | 1 | 0 | 0 |
| LBAL0016-00 | Mix Manifold Assembly, HP | Fluid Panel | 0 | 0 | 1 | 1 |

# TROUBLESHOOTING

Although the RF2 is a complex machine, troubleshooting the unit is straightforward, with a few basic steps.

## ALARM LIST

The alarm dialog is the first indication that something may be wrong with the RF2 control processes. Below is a list of alarms and troubleshooting steps.

| ALARM DESCRIPTION | DETAILS & TROUBLESHOOTING TIPS |
|---|---|
| Safety Fault | The safety circuit for the RF2 is open, operation is not possible |
| | This fault most occurs in conjunction with other alarms, such as an E-Stop pressed, fire-detect, etc. Address any of these faults before troubleshooting further.<br>If no other fault is present with this one, check the wiring of the safety relay. See schematics for more details. |
| E-Stop PB Pressed | The E-Stop on the front of the RF2 control enclosure has been pressed. |
| | Pull the emergency stop pushbutton to reset the alarm |
| Festo VTEM Pressure Regulator Module (x) Fault | The indicated module (x) has on the Festo pressure regulator manifold has a fault. |
| | Most often, this alarm will occur at the same time as all other pressure regulator modules. This is most often caused by a lack of input air pressure being fed to the manifold.<br>Make sure main air pressure is turned on.<br>Press "Reset" button on the main HMI.<br>If the fault persists, see section on troubleshooting the pressure regulator manifold further. |
| Comm Loss with Master Controller | After having been established, communications between the supervisory (master) PLC and the RF2 has been interrupted. |
| | Check master process controller for proper operation.<br>Power cycle the RF2<br>Check cabling between master controller and RF2 unit. |
| Comm Loss with Aux. Communications Gateway | The AnyBus gateway installed, and communications between it and the RF2 controller have been interrupted. |
| | Power cycle the RF2<br>Check cabling between the RF2 and the AnyBus gateway. |
| Station (x)-Recipe Update Failed | The indicated station (x) has had a failure in loading a recipe (timeout occurred). |
| | Try loading the recipe again.<br>Power cycle the RF2<br>Contact Technical Support |

| ALARM DESCRIPTION | DETAILS & TROUBLESHOOTING TIPS |
|---|---|
| Station (x)-Fluid Sequence Failed | The indicated station (x) has experienced a failed (incomplete) fluid sequence. Material may not be properly loaded or purged from the system. |
| | This occurs when an interlock is lost during a sequence. Check all wired interlocks to make sure these are not turning on at inappropriate times. |
| | Check other alarms that may have occurred in conjunction with this for more detailed cause analysis. |
| | Retry running the fluid sequence |
| Station (x)-Solvent Flow Low | The indicated station (x) has run a sequence, and detected not enough solvent flow in comparison to the solvent check settings. |
| | Make sure solvent supply is adequate and not restricted. |
| | Check Solvent Flow Meter |
| | Check timing of fluid sequence to make sure that solvent flow occurs for enough time to flush the system. |
| Pot Life Expired | The material pot life for the indicated Gun/Mixer has elapsed. |
| | If safe to do so, trigger the gun/mixer in order to allow fresh material into the system-OR flush the system. |
| Ratio Out Of Tolerance | The RF2 has calculated that the ratio of mixtures A:B or %C has deviated by more than the allowed tolerance. |
| | Determine if fluid delivery is ok, fluid pressures are correctly set, etc. |
| | Check for restrictions in any of the fluid channels. |
| | Check material viscosity for abnormalities |
| | Check recipe settings for ratio tolerance. |
| Flow Rate Out Of Tolerance | The RF2 has calculated that the overall flow rate is out of tolerance. |
| | Determine if fluid delivery is ok, fluid pressures are correctly set, etc. |
| | Check for restrictions in any of the fluid channels. |
| | Check material viscosity for abnormalities |
| | Check recipe settings for flow tolerance |
| Ratio Shutdown | A Ratio Out Of Tolerance fault has been generated, shutting down the station. |
| | Determine if fluid delivery is ok, fluid pressures are correctly set, etc. |
| | Check for restrictions in any of the fluid channels. |
| | Check material viscosity for abnormalities |
| | Check recipe settings for ratio tolerance. |
| | See the alarm-masking instructions to disable the shutdown of the system for this fault. |

| ALARM DESCRIPTION | DETAILS & TROUBLESHOOTING TIPS |
|---|---|
| Flow Rate Shutdown | A Flow Rate Out Of Tolerance Fault has occurred, shutting down the station. |
| | Determine if fluid delivery is ok, fluid pressures are correctly set, etc. |
| | Check for restrictions in any of the fluid channels. |
| | Check material viscosity for abnormalities |
| | Check recipe settings for flow tolerance |
| | See the alarm-masking instructions to disable the shutdown of the system for this fault. |
| Channel (x)-Outlet Underpressure | The indicated channel (x) has detected low pressure on its outlet pressure sensor (applicable only for gear-pump controlled channels). |
| | Determine if fluid delivery is ok, fluid pressures are correctly set, etc. |
| | Check for restrictions in the tubing feeding this channel. |
| | Check material viscosity for abnormalities |
| | Check settings for low pressure. |
| | Check pressure sensor scaling/operation. |
| Channel (x)-Outlet Overpressure | The indicated channel (x) has detected high pressure on its outlet pressure sensor (applicable only for gear-pump controlled channels). This event will cause a spray-shutdown. |
| | The indicated channel (x) has detected low pressure on its outlet pressure sensor (applicable only for gear-pump controlled channels). |
| | Determine if fluid delivery is ok, fluid pressures are correctly set, etc. |
| | Check for restrictions in the tubing downstream from this channel. |
| | Check material viscosity for abnormalities |
| | Check settings for high pressure. |
| | Check settings for trigger timing |
| | Check pressure sensor scaling / operation. |
| Channel (x)-Inlet Underpressure | The indicated channel (x) has detected low pressure on its inlet pressure sensor (applies only to the gear-pump controlled channels). |
| | Determine if fluid delivery is ok, fluid pressures are correctly set, etc. |
| | Check for restrictions in the tubing feeding this channel. |
| | Check material viscosity for abnormalities |
| | Check settings for low pressure. |
| | Check pressure sensor scaling/operation. |
| Channel (x)-Inlet Overpressure | The indicated channel (x) has detected high pressure on its inlet pressure sensor (applicable only for gear-pump controlled channels). |
| | Determine if fluid delivery is ok, fluid pressures are correctly set, etc. |
| | Check for restrictions in the tubing feeding this channel. |
| | Check material viscosity for abnormalities |
| | Check settings for high pressure. |
| | Check pressure sensor scaling/operation. |

| ALARM DESCRIPTION | DETAILS & TROUBLESHOOTING TIPS |
|---|---|
| Channel (x)-Low Flow | RF2 has determined flow rate for this channel is low. |
| | Determine if fluid delivery is ok, fluid pressures are correctly set, etc.<br>Check for restrictions in any of the fluid channels.<br>Check material viscosity for abnormalities<br>Check recipe settings for flow tolerance<br>Check Flow Sensor Calibration/Operation |
| Channel (x)-High Flow | RF2 has determined flow rate for this channel is high. |
| | Determine if fluid delivery is ok, fluid pressures are correctly set, etc.<br>Check for restrictions in any of the fluid channels.<br>Check material viscosity for abnormalities<br>Check recipe settings for flow tolerance<br>Check Flow Sensor Calibration/Operation |
| Channel (x)-Flow Feedback Loss | Zero flow is detected by the RF2 for the indicated channel (x) |
| | Determine if fluid delivery is ok, fluid pressures are correctly set, etc.<br>Check for restrictions in any of the fluid channels.<br>Check material viscosity for abnormalities<br>Check recipe settings for flow tolerance<br>Check Flow Sensor Calibration/Operation |
| Channel (x)-Spray Shutdown | The indicated channel (x) has caused a spray shutdown, due to a flow or feedback fault that has been configured to shut down the system. |
| | Address other channel faults that occurred in conjunction with this fault.<br>See the alarm-masking instructions to disable the shutdown of the system for this fault. |
| Channel (x)-Reverse Flow Detected | The RF2 has detected flow in the reverse direction, exceeding the reverse-flow volume setting. This will cause a spray shutdown. |
| | Inspect check-valves on mix manifold and color stacks.<br>Check wiring to flow meter<br>Check trigger timing settings<br>Check settings for reverse flow volume. It is normal to detect a small reverse reading when triggering off, as the fluid may create a wave in the reverse direction momentarily. This condition does not indicate fluid has passed beyond the check valve. |
| Channel (x)-Inlet Pressure Loss of Feedback | If an inlet pressure sensor is configured (gear-pump systems only), the RF2 has detected no feedback from the inlet pressure sensor. |
| | Check pressure sensor scaling/operation. |
| Channel (x)-Outlet Pressure Loss of Feedback | If an outlet pressure sensor is configured (gear-pump systems only), the RF2 has detected no feedback from the outlet pressure sensor. |
| | Check pressure sensor scaling/operation. |

| ALARM DESCRIPTION | DETAILS & TROUBLESHOOTING TIPS |
|---|---|
| Channel (x)-Flow Out Of Range | The flow actuator (MVR or DR1) is operating at its maximum pilot pressure signal, but flow rate is low. |
| | Check that the desired flow rate is attainable given the system flow restrictions (gun tip settings, tubing size and lengths, etc.)<br>Check material viscosity for abnormalities |
| Channel (x)-Unconfigured Inlet Pressure Pilot | The indicated channel has been configured with inlet pressure control, but no pressure regulator has been assigned for this purpose. |
| | Check System Configuration Settings |
| Channel (x)-Unconfigured Flow Pressure Pilot | No flow rate pilot signal has been assigned to a regulator. |
| | Check System Configuration Settings |

## TROUBLESHOOTING—FESTO VTEM PRESSURE REGULATOR MANIFOLD

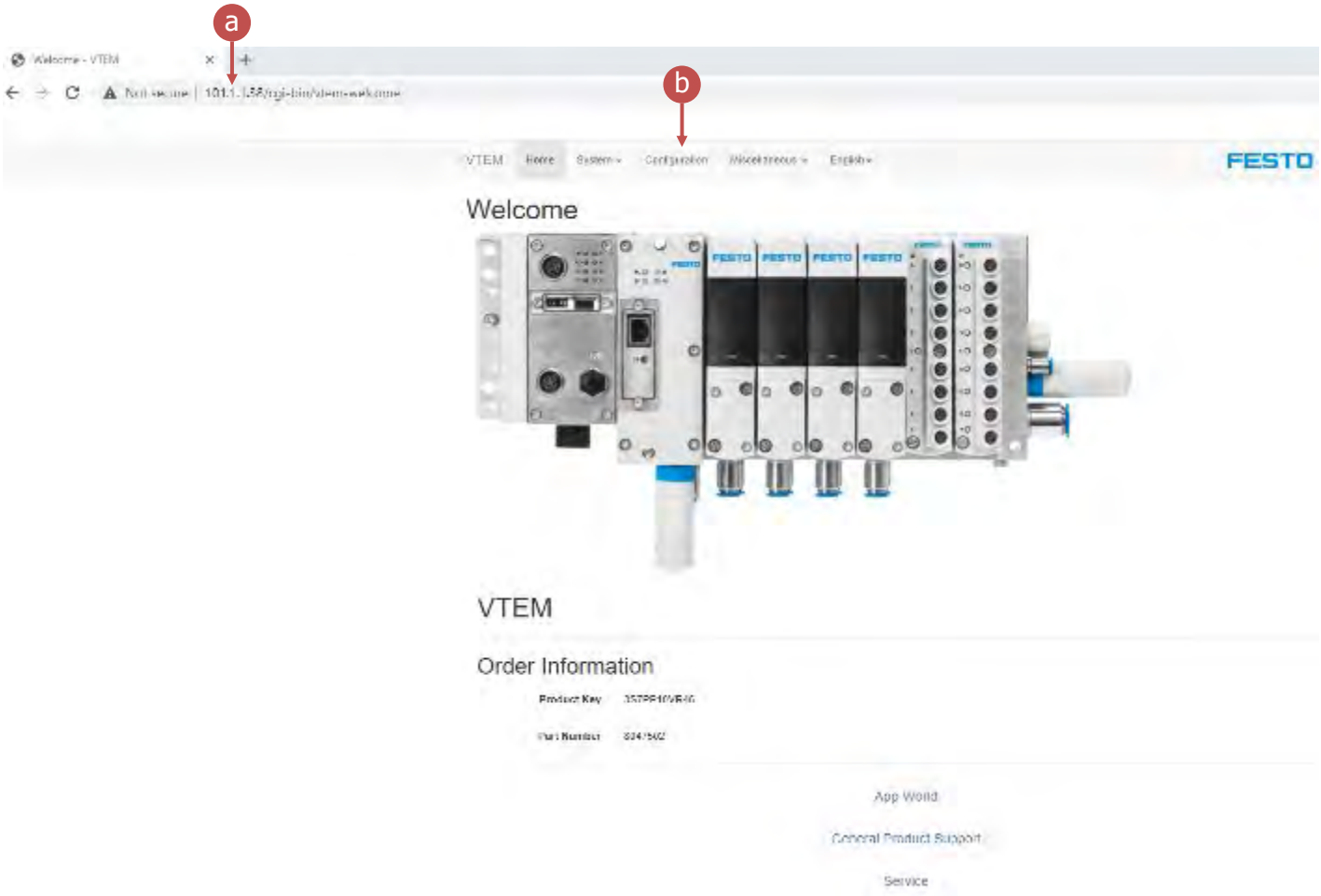
If an issue with the Festo VTEM Pressure regulator manifold occurs, the unit can access more detailed troubleshooting.

First locate the RJ45 port (1) used to configure the VTEM module, then connect a PC to this port.

Set the IP address of the connected PC to 101.1.1.99.

Open a web browser and enter 101.1.1.38 (a)

To troubleshoot a module, click the configuration tab (b).



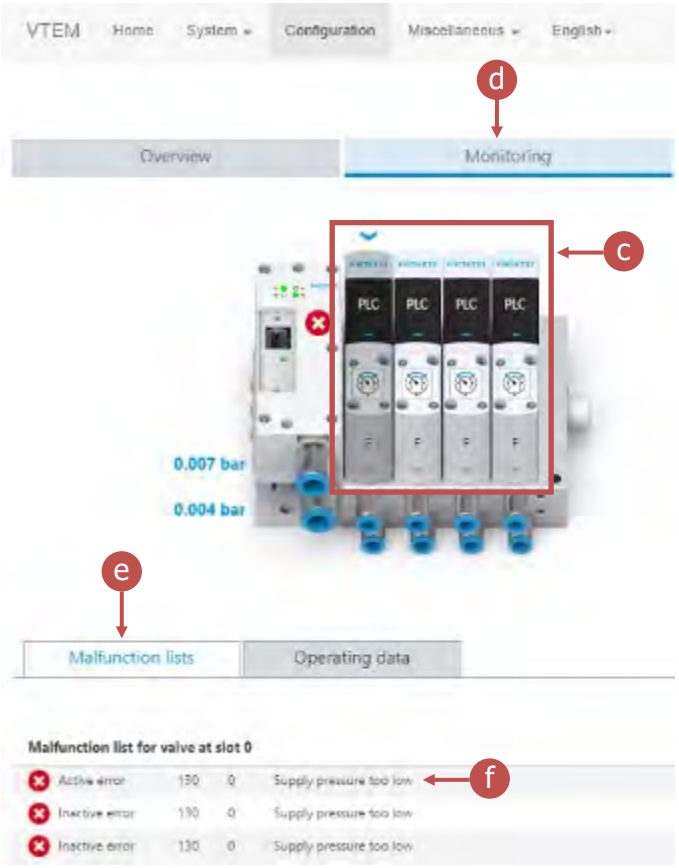
Click on any module to select it (c).

Select the monitor tab (d) to show a list of malfunctions (e).

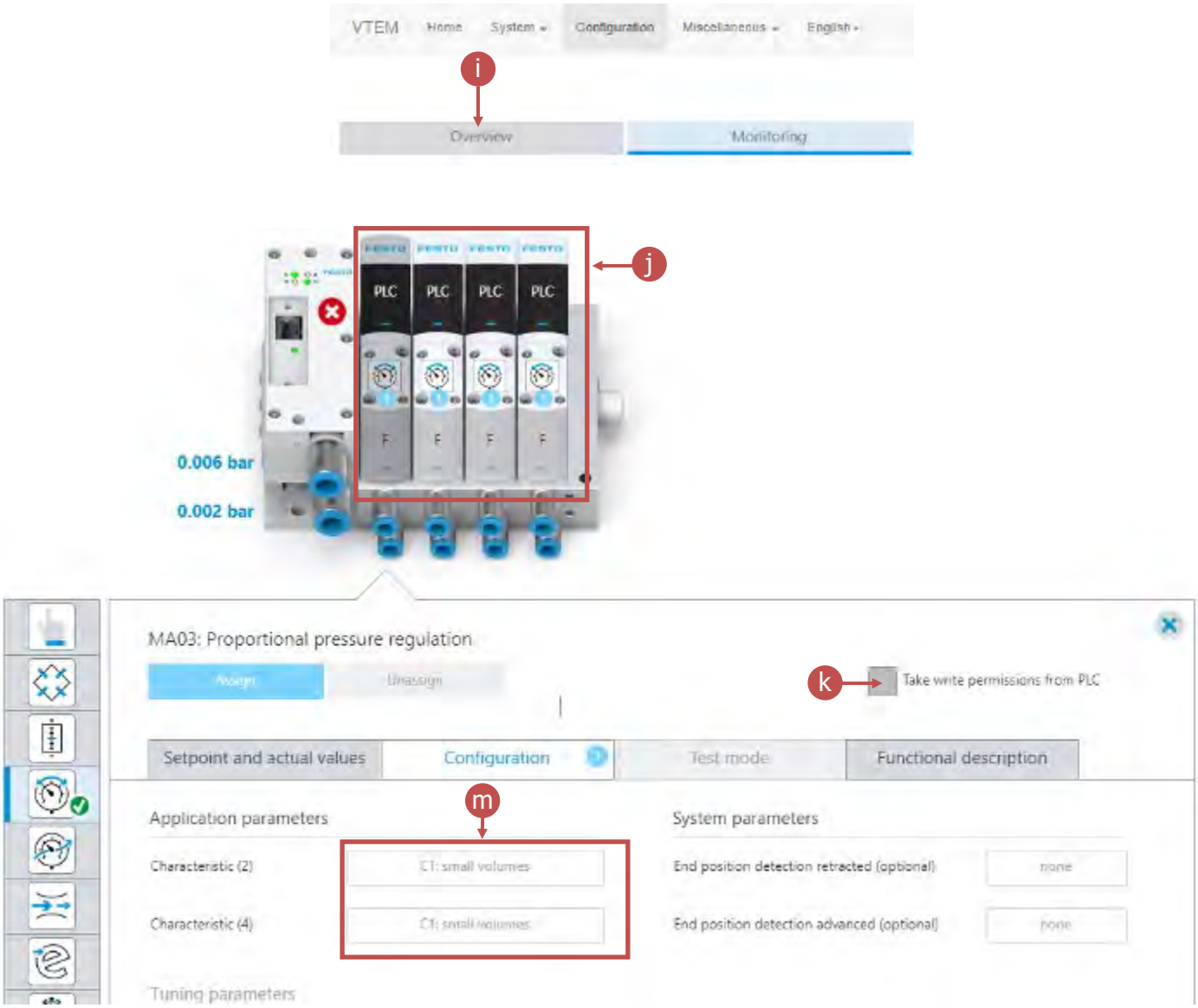
The example below shows that the supply pressure is too low (f).

If the fluid panels for the RF2 are installed too far from the unit, tune the pressure regulators. To do this, press the login key (g) and enter the password (h) to log into the VTEM unit.

**The factory default password is "vtem." DO NOT change this password.**

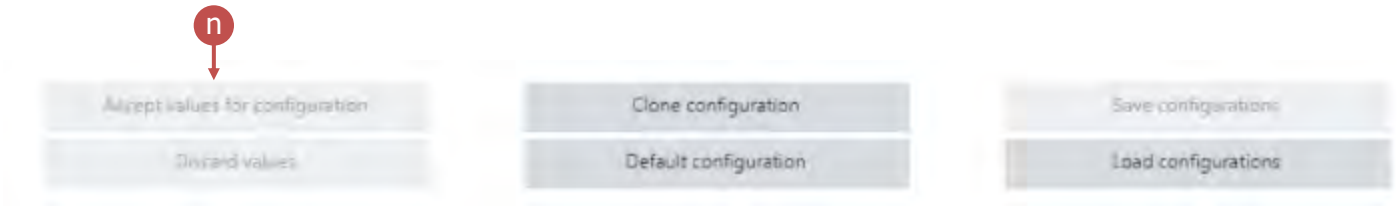



Once logged in, select the overview tab (i) and the module (j) to edit. It is necessary to "Take Write Permissions from the PLC" (k) to make any changes. Changes are not permitted when the PLC is in communication with the VTEM manifold, so the M12 Ethernet cable at the front of the manifold must be unplugged to select the box below.




To change the tune, determine the labeled module port (4 or 2) to be connected to the tube type. Select the small, medium, or large volume setting from the dropdown menu to change the "Characteristic" (m) parameter. Additionally, the regulator can be custom tuned.

When edits are made, select "Accept values for configuration" (n), then press "Save Configurations" (o). If the configuration is not saved, the unit will revert to its earlier settings upon start-up.



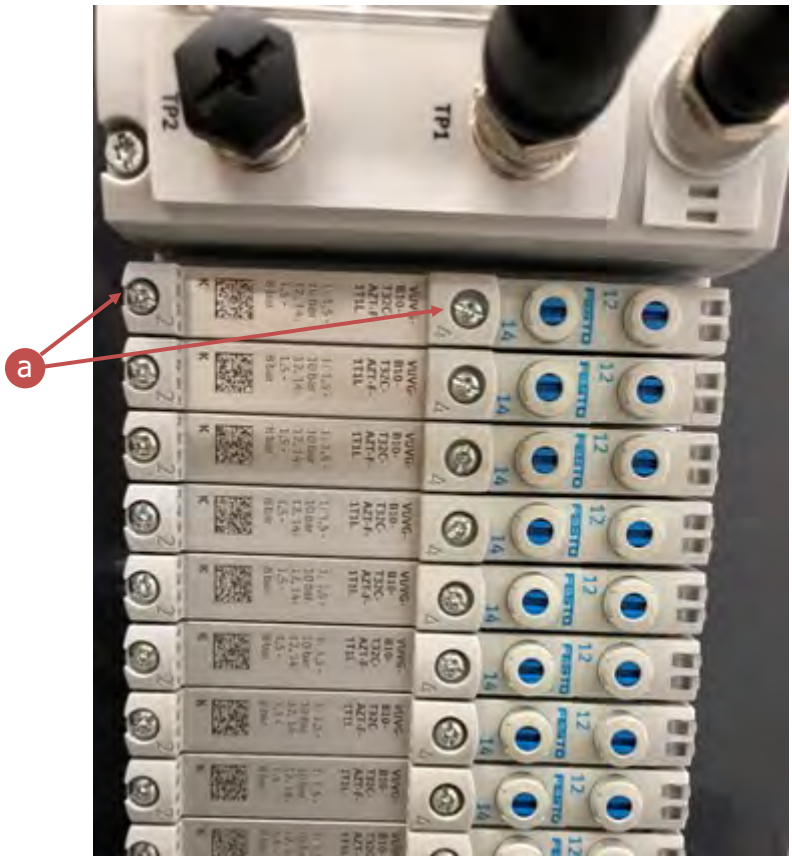

## TROUBLESHOOTING—FESTO VTUG SOLENOID MANIFOLD

To replace a defective pressure regulator module, loosen the bolts on the module, then pull the module directly out. Make sure the new module's gasket is correctly located in its channel, and press it down and into the open slot. Tighten the bolts, but do not tightly squeeze the gasket.

Consult Festo VTEM operations manual for more details.

**⚠ WARNING**

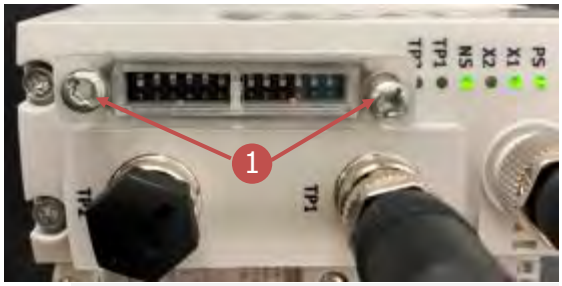
Make sure the air is disconnected before attempting to remove a solenoid module.



- The RF2 can control up to four solenoid modules. These modules can be installed later in the field if not initially installed in the purchased configuration. Each manifold (1-4) must be set to a specific IP address as listed below:
- Manifold #1: 101.1.1.30
- Manifold #2: 101.1.1.31
- Manifold #3: 101.1.1.32
- Manifold #4: 101.1.1.33
- Subnet mask for all manifolds is 255.255.255.0

To set the IP address–do the following:

1. Remove the cover to access the dip switches on the front of the CTEU-EP communications module on the solenoid manifold.
2. Set the dip switches for the last octet of the IP address.
3. Connect a PC to the ethernet port of the CTEU, or connect through an ethernet switch. Set the laptop to IP address 192.168.1.99



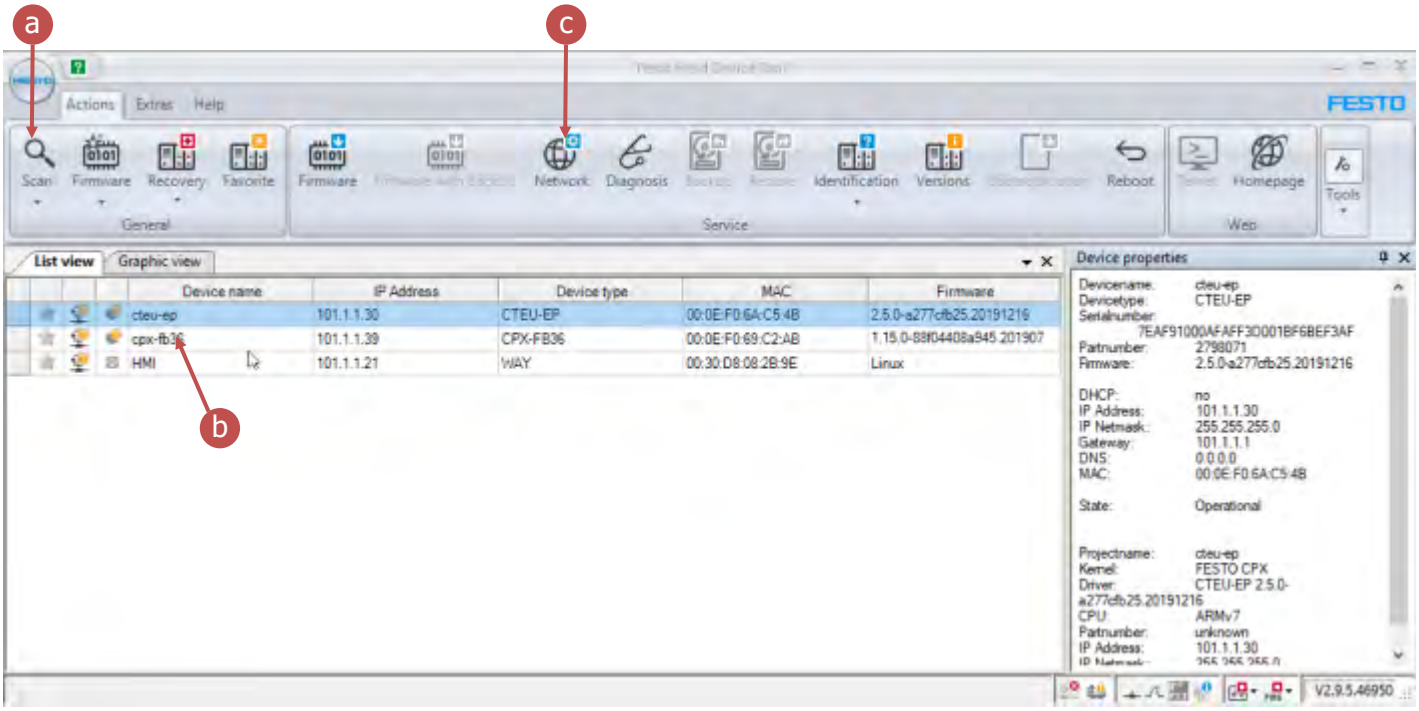

From left to right.

1-1 = least significant bit.

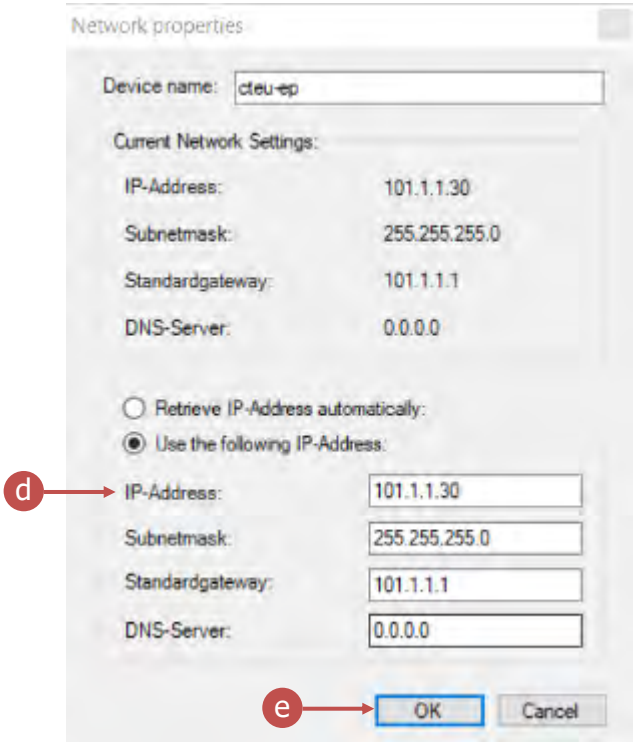
2-2 = most significant bit

Leave 2-3 – 2-6 at zero.

4. Open "Festo Field Device Tool" software. This can be downloaded from Festo's website.
5. Scan (a) the network and find the module (b) you wish to modify. Highlight it and select "Network" (c).




6. Change the IP settings (d) to 101.1.1.x (from list specified in the previous page).




7. Click OK
8. Return PC IP Address to normal, re-cover the dip-switches.

# APPENDIX

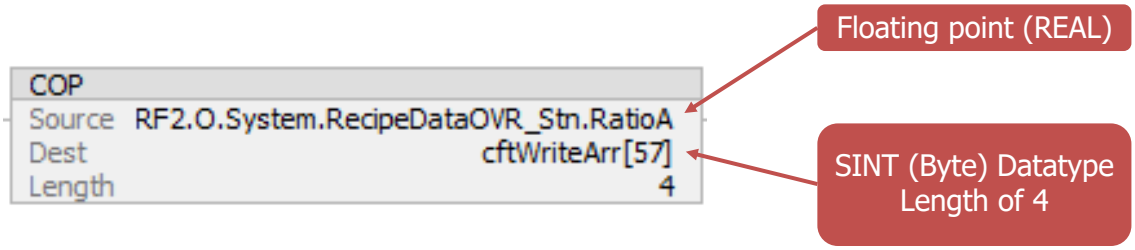
## FIELDBUS I/O

There are two methods for communicating to the RF2 over fieldbus.

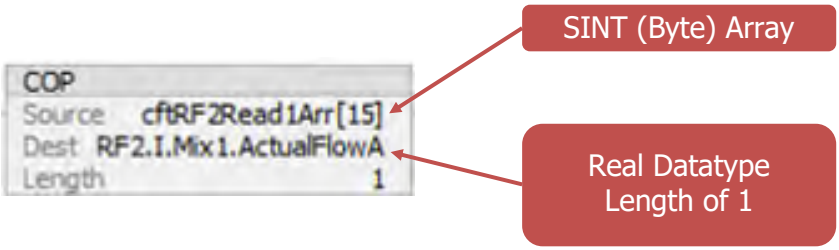
- Direct CIP access to tag arrays given below. No gateway is used.
    - RF2 Input Array (PLC -> RF2):
        - AuxInArr (SINT 496)
    - RF2 Output Arrays (RF2 -> PLC):
        - AuxOutArr1 (SINT 496)
        - AuxOutArr2 (SINT 496)
- Access through AnyBus gateway (if purchased).
    - In this method, the communications protocol is converted from the customer's side to Ethernet/IP on the RF2 side. Tag registers within the RF2 are overwritten by the tags communicated through the gateway.

Carlisle can provide sample or importable code for Rockwell software solutions for both methods above.

Datatypes that are in the form of BOOL, integer (INT), double integer (DINT), or Floating Point (REAL), are represented by varying amounts of bytes. The code used in the master controller must take this into account – for example:




The above code copies a real value into 4 bytes.




The above code copies 4 bytes into a real value.

**NOTE**

The examples shown above are Allen Bradley software. Other PLC software can have different methods to accomplish datatype conversions.

Communications Handshake: The RF2 will fault if it detects a connection has been lost between its master controller and itself after communications has been established. It detects communications through a handshaking word which it increments after the master controller has echoed it back. The master controller communicating must set its output byte #1 equal to its input byte #1 continuously.

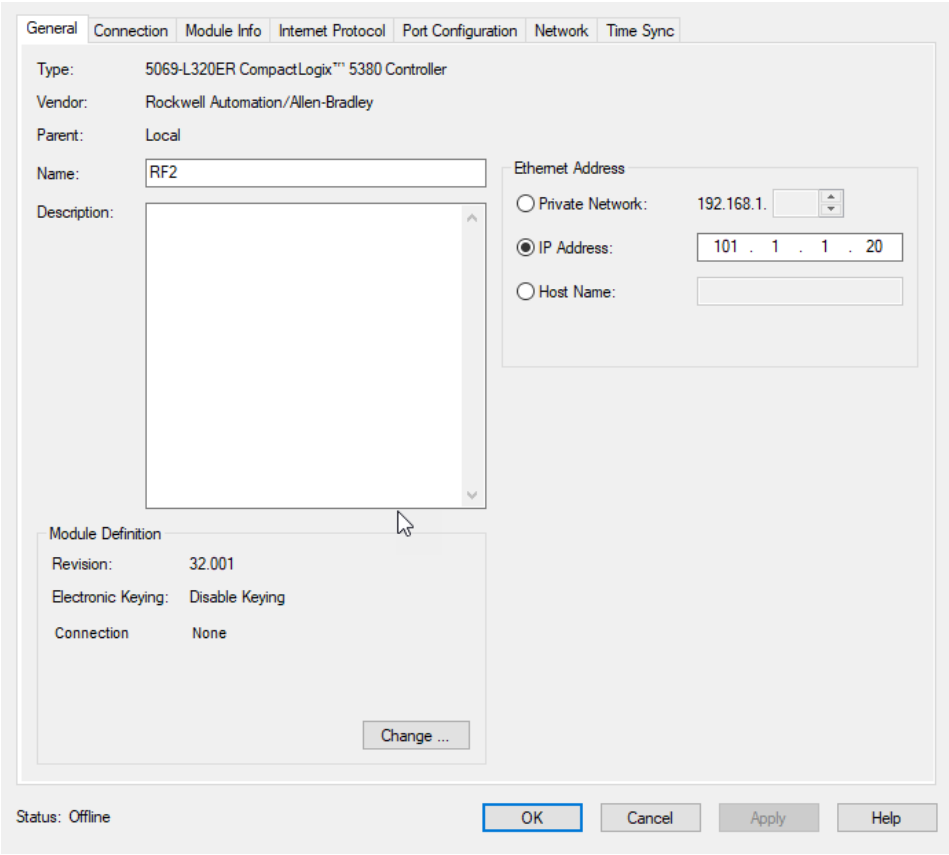
## Direct Access/CIP Communications

If an Allen Bradley Logix PLC is used, or another controller where direct access to the RF2 input and output arrays (AuxInArr, AuxOutArr1, AuxOutArr2) is possible, no gateway or special hardware is needed to communicate to the RF2. All the RF2 communications arrays are in the form of 496 SINT Data types.

## CIP Message Setup

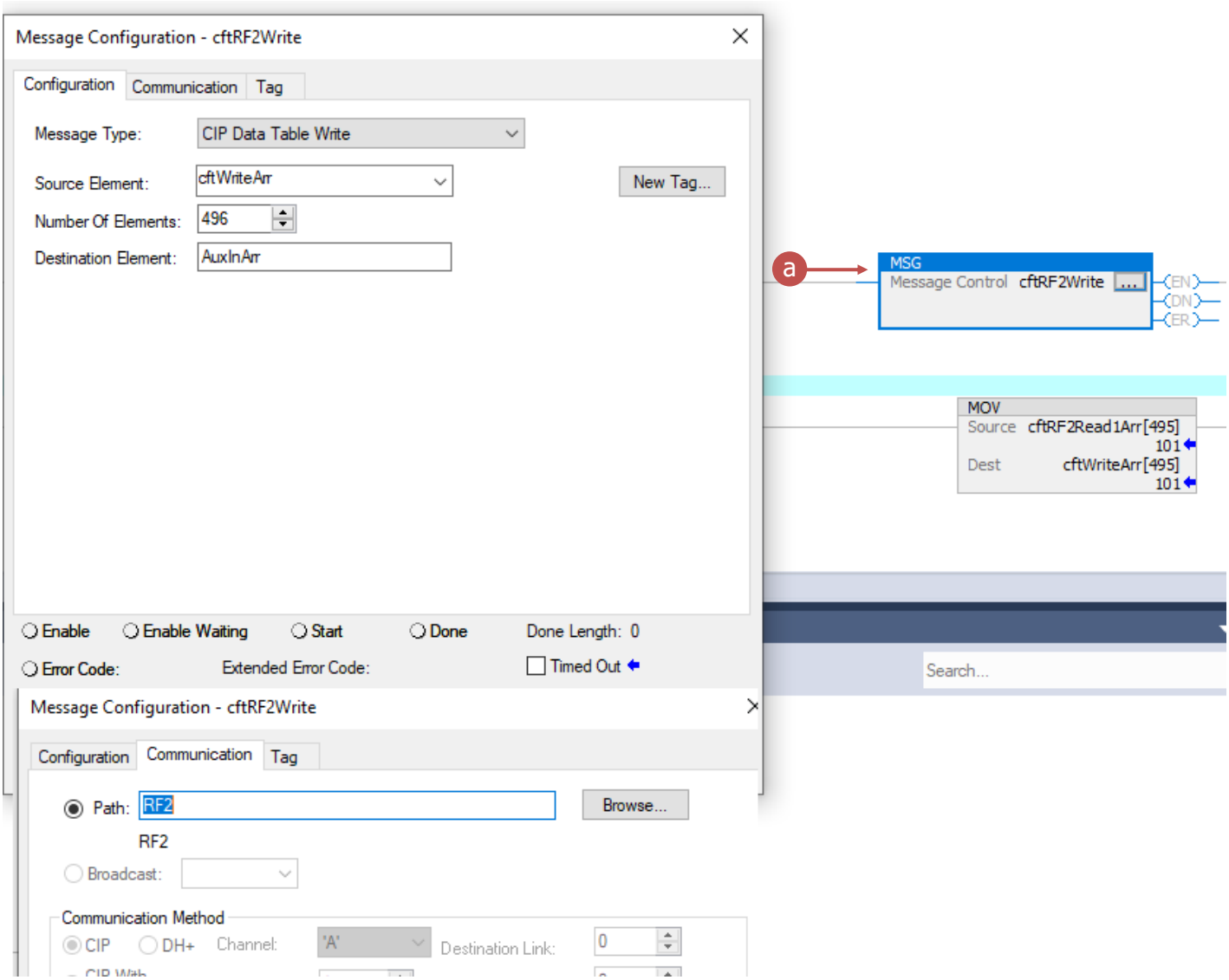
To make the RF2 as flexible as possible in being able to communicate to as many devices as possible, with different IP address configurations, etc. All communications are handled by the master controller, and the RF2 simply contains the tag arrays used for the transfer. Examples of Allen Bradley message setups are shown below.

Note: The code examples below will be put into the master PLC. Other PLCs or systems can use different methods to get the data into the RF2's tag arrays.

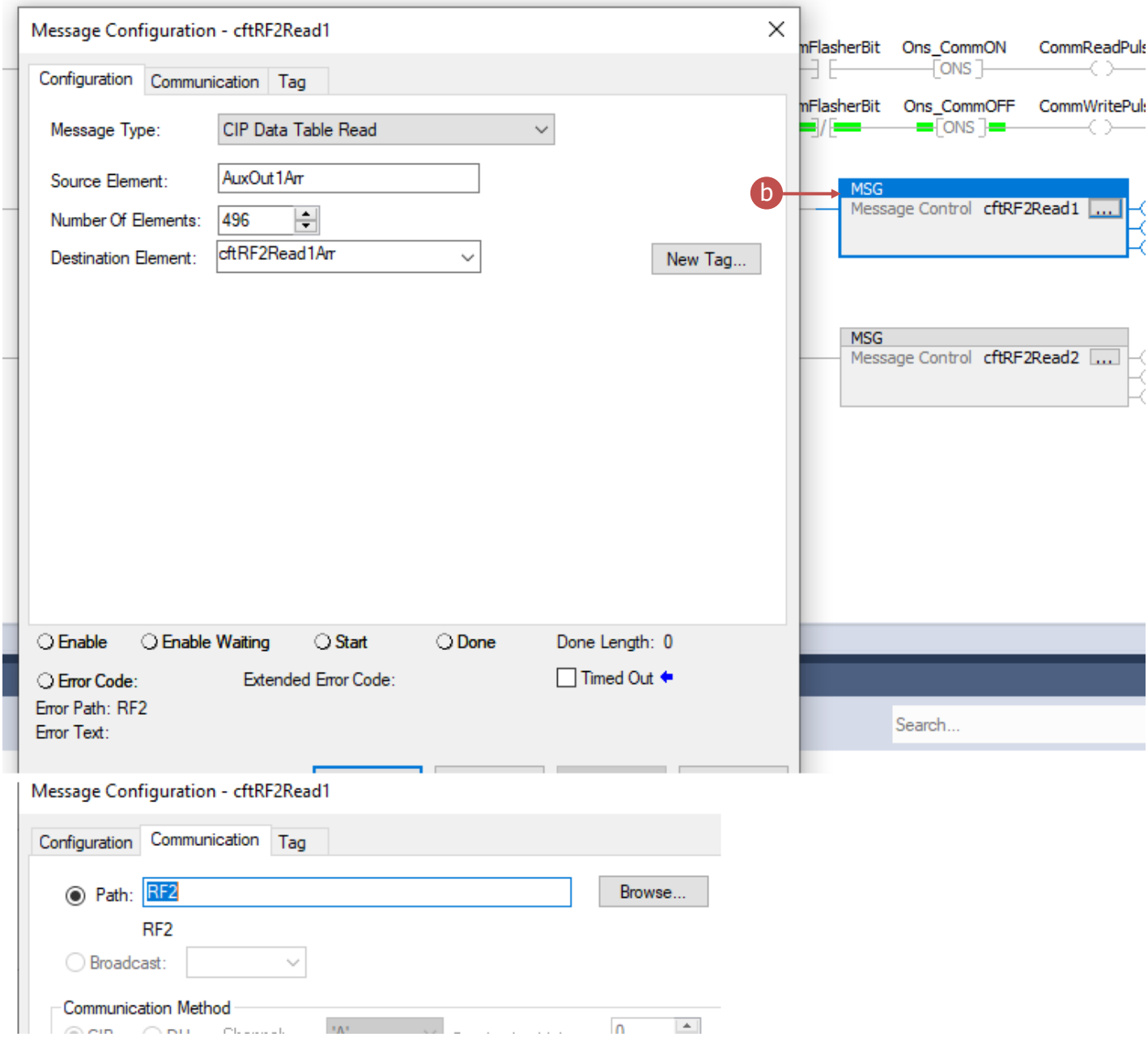



RF2 Node Setup in an Allen Bradley PLC.

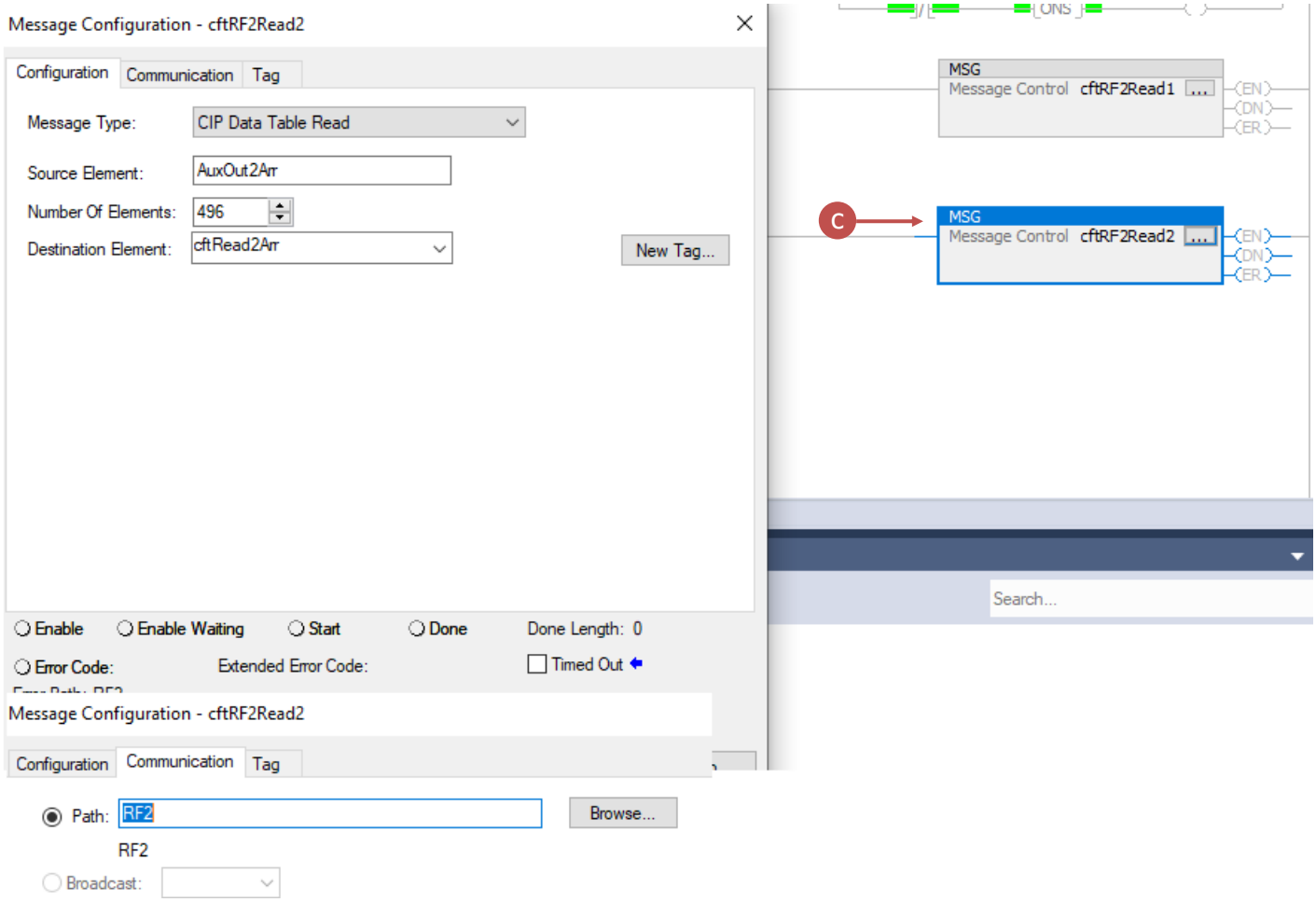
IP Address: Set to IP assigned to the A2 port of the RF2s Compact Logix PLC. See "Setting the IP Address for Fieldbus Communications (No Gateway)" in the Installation Chapter for more details.




RF2 Input Array (Master PLC Write) (a)




RF2 Output Array 1 (Master PLC Read) (b)




RF2 Output Array 2 (Master PLC Read) (c)

Message Polling: It is recommended to poll the messages on a periodic interval. In the example code the RF2 Inputs and Outputs are offset by 20 milliseconds. Note–it is not always necessary to receive both RF2 Output Arrays–the second array is used only if active recipe data is being communicated, which is not required for running the RF2.

The RF2 Communications arrays represent the following data:

| RF2 INPUT ARRAY-SINT 496 | | | |
|---|---|---|---|
| **Address** | **Length** | **Datatype** | **Description** |
| 0 | 1 Byte | SINT | System Control Byte 0-See Detail Below |
| 1 | 1 Byte | SINT | Handshake Word |
| 2 | 1 Byte | SINT | Station 1 Control Byte 0-See Detail Below |
| 3 | 1 Byte | SINT | Station 1 Control Byte 1-See Detail Below |
| 4, 5 | 2 Byte | INT | Station 1 Job Select (1-250). This job will be loaded when the Station Job Strobe bit is activated. |
| 6 | 1 Byte | SINT | Station 2 Control Byte 0-See Detail Below |
| 7 | 1 Byte | SINT | Station 2 Control Byte 1-See Detail Below |
| 8, 9 | 2 Byte | INT | Station 2 Job Select (1-250). This job will be loaded when the Station Job Strobe bit is activated. |
| 10 | 1 Byte | SINT | Station 3 Control Byte 0-See Detail Below |
| 11 | 1 Byte | SINT | Station 3 Control Byte 1-See Detail Below |
| 12, 13 | 2 Byte | INT | Station 3 Job Select (1-250). This job will be loaded when the Station Job Strobe bit is activated. |
| 14 | 1 Byte | SINT | Station 4 Control Byte 0-See Detail Below |
| 15 | 1 Byte | SINT | Station 4 Control Byte 1-See Detail Below |
| 16, 17 | 2 Byte | INT | Station 4 Job Select (1-250). This job will be loaded when the Station Job Strobe bit is activated. |
| 19, 39 | | SINT | RESERVED |
| 40 | 1 Byte | SINT | Gun/Mix 1 Trigger |
| 41 | 1 Byte | SINT | RESERVED FOR ADDL MIX CTRL |
| 42, 43 | 2 Byte | INT | Gun/Mix 1 Flow Command (0-3500 cc) |
| 44 | 1 Byte | SINT | Gun/Mix 2 Trigger |
| 45 | 1 Byte | SINT | RESERVED FOR ADDL MIX CTRL |
| 46, 47 | 2 Byte | INT | Gun/Mix 2 Flow Command (0-3500 cc) |
| 48 | 1 Byte | SINT | Gun/Mix 3 Trigger |
| 49 | 1 Byte | SINT | RESERVED FOR ADDL MIX CTRL |

| RF2 INPUT ARRAY-SINT 496 (cont.) | | | |
|---|---|---|---|
| **Address** | **Length** | **Datatype** | **Description** |
| 50, 51 | 2 Byte | INT | Gun/Mix 3 Flow Command (0-3500 cc) |
| 52 | 1 Byte | SINT | Gun/Mix 4 Trigger |
| 53 | 1 Byte | SINT | RESERVED FOR ADDL MIX CTRL |
| 54, 55 | 2 Byte | INT | Gun/Mix 4 Flow Command (0-3500 cc) |
| 56 | 1 Byte | SINT | Gun/Mix 5 Trigger |
| 57 | 1 Byte | SINT | RESERVED FOR ADDL MIX CTRL |
| 58, 59 | 2 Byte | INT | Gun/Mix 5 Flow Command (0-3500 cc) |
| 60 | 1 Byte | SINT | Gun/Mix 6 Trigger |
| 61 | 1 Byte | SINT | RESERVED FOR ADDL MIX CTRL |
| 62, 63 | 2 Byte | INT | Gun/Mix 6 Flow Command (0-3500 cc) |
| 64 | 1 Byte | SINT | Gun/Mix 7 Trigger |
| 65 | 1 Byte | SINT | RESERVED FOR ADDL MIX CTRL |
| 66, 67 | 2 Byte | INT | Gun/Mix 7 Flow Command (0-3500 cc) |
| 68 | 1 Byte | SINT | Gun/Mix 8 Trigger |
| 69 | 1 Byte | SINT | RESERVED FOR ADDL MIX CTRL |
| 70, 71 | 2 Byte | INT | Gun/Mix 8 Flow Command (0-3500 cc) |
| 72 | 1 Byte | SINT | Request Totals-Gun/Mix (1-8=View Totals for Gun/Mix 1-8) |
| 73 | 1 Byte | SINT | Request Totals-Time Range (0 = Grand, 1 = Yearly, 2 = Monthly, 3 = Weekly, 4 = Daily, 5 = Hourly) |
| 74, 75 | 2 Byte | INT | Request Totals-Job (0 = All Jobs, 1-250 = Job 1-250) |

| RF2 INPUT ARRAY-SINT 496 (cont.) | | | |
|---|---|---|---|
| **Address** | **Length** | **Datatype** | **Description** |
| 76, 99 | - | SINT | Reserved |
| 100, 101 | 2 Byte | INT | Read Register #1 Tag ID |
| 102, 103 | 2 Byte | INT | Read Register #2 Tag ID |
| 104, 105 | 2 Byte | INT | Read Register #3 Tag ID |
| 106, 107 | 2 Byte | INT | Read Register #4 Tag ID |
| 108, 109 | 2 Byte | INT | Read Register #5 Tag ID |
| 110, 111 | 2 Byte | INT | Read Register #6 Tag ID |
| 112, 113 | 2 Byte | INT | Read Register #7 Tag ID |
| 114, 115 | 2 Byte | INT | Read Register #8 Tag ID |
| 116, 117 | 2 Byte | INT | Read Register #9 Tag ID |
| 118, 119 | 2 Byte | INT | Read Register #10 Tag ID |
| 120, 139 | - | Byte | RESERVED |
| 140, 141 | 2 Byte | INT | Write Register #1 Tag ID |
| 142, 143 | 2 Byte | INT | Write Register #2 Tag ID |
| 144, 145 | 2 Byte | INT | Write Register #3 Tag ID |
| 146, 147 | 2 Byte | INT | Write Register #4 Tag ID |
| 148, 149 | 2 Byte | INT | Write Register #5 Tag ID |
| 150, 151 | 2 Byte | INT | Write Register #6 Tag ID |
| 152, 153 | 2 Byte | INT | Write Register #7 Tag ID |
| 154, 155 | 2 Byte | INT | Write Register #8 Tag ID |
| 156, 157 | 2 Byte | INT | Write Register #9 Tag ID |
| 158, 159 | 2 Byte | INT | Write Register #10 Tag ID |
| 160, 179 | - | Byte | RESERVED |
| 180, 183 | 4 Byte | DINT/REAL | Write Register #1 Data (Real or DINT) format |

| RF2 INPUT ARRAY-SINT 496 (cont.) | | | |
|---|---|---|---|
| **Address** | **Length** | **Datatype** | **Description** |
| 184, 187 | 4 Byte | DINT/REAL | Write Register #2 Data (Real or DINT) format |
| 188, 191 | 4 Byte | DINT/REAL | Write Register #3 Data (Real or DINT) format |
| 192, 195 | 4 Byte | DINT/REAL | Write Register #4 Data (Real or DINT) format |
| 196, 199 | 4 Byte | DINT/REAL | Write Register #5 Data (Real or DINT) format |
| 200, 203 | 4 Byte | DINT/REAL | Write Register #6 Data (Real or DINT) format |
| 204, 207 | 4 Byte | DINT/REAL | Write Register #7 Data (Real or DINT) format |
| 208, 211 | 4 Byte | DINT/REAL | Write Register #8 Data (Real or DINT) format |
| 212, 215 | 4 Byte | DINT/REAL | Write Register #9 Data (Real or DINT) format |
| 216, 219 | 4 Byte | DINT/REAL | Write Register #10 Data (Real or DINT) format |
| 220, 259 | - | Byte | RESERVED |
| 260 | 1 Byte | SINT | User Input Bits (0..7 = Input 1-8) |
| 261 | 1 Byte | SINT | User Input Bits (0..7 = Input 9-16) |
| 262 | 1 Byte | SINT | User Input Bits (0..7 = Input 17-24) |
| 263 | 1 Byte | SINT | User Input Bits (0..7 = Input 25-32) |
| 264, 495 | - | - | Reserved |

| SYSTEM CONTROL BYTE 0 | | | |
|---|---|---|---|
| **Address** | **Length** | **Datatype** | **Description** |
| 0.0 | 1 Bit | Bool | Fault Reset |
| 0.1 | 1 Bit | Bool | Spare |
| 0.2 | 1 Bit | Bool | Spare |
| 0.3 | 1 Bit | Bool | Spare |
| 0.4 | 1 Bit | Bool | Spare |
| 0.5 | 1 Bit | Bool | Spare |
| 0.6 | 1 Bit | Bool | Spare |
| 0.7 | 1 Bit | Bool | Spare |

| SYSTEM CONTROL BYTE 0 | | | |
|---|---|---|---|
| **Address** | **Length** | **Datatype** | **Description** |
| x.0 | 1 Bit | Bool | Strobe Job |
| x.1 | 1 Bit | Bool | Purge |
| x.2 | 1 Bit | Bool | Spare |
| x.3 | 1 Bit | Bool | Seq Run Bit * |
| x.4 | 1 Bit | Bool | Seq Select Bit 0 * |
| x.5 | 1 Bit | Bool | Seq Select Bit 1 * |
| x.6 | 1 Bit | Bool | Seq Select Bit 2 * |
| x.7 | 1 Bit | Bool | Seq Select Bit 3 * |
| *When Seq Run Bit is active, the selected sequence is the binary representation of the Seq Select Bits. A value of 0-15 will call sequence 1-16 in the sequence list. | | | |

| SYSTEM CONTROL BYTE 1 | | | |
|---|---|---|---|
| **Address** | **Length** | **Datatype** | **Description** |
| x.0 | 1 Bit | Bool | Run Mode Pulse |
| x.1 | 1 Bit | Bool | Halt Pulse |
| x.2 | 1 Bit | Bool | Spare |
| x.3 | 1 Bit | Bool | Spare |
| x.4 | 1 Bit | Bool | Spare |
| x.5 | 1 Bit | Bool | Spare |
| x.6 | 1 Bit | Bool | Spare |
| x.7 | 1 Bit | Bool | Spare |

| GUN/MIX TRIGGER WORD | | | |
|---|---|---|---|
| **Address** | **Length** | **Datatype** | **Description** |
| x.0 | 1 Bit | Bool | Trigger 1 |
| x.1 | 1 Bit | Bool | Trigger 2 |
| x.2 | 1 Bit | Bool | Trigger 3 |
| x.3 | 1 Bit | Bool | Trigger 4 |
| x.4 | 1 Bit | Bool | Spare |
| x.5 | 1 Bit | Bool | Spare |
| x.6 | 1 Bit | Bool | Spare |
| x.7 | 1 Bit | Bool | Spare |

| RF2 OUTPUT ARRAY 1-SINT 496 | | | |
|---|---|---|---|
| **Address** | **Length** | **Datatype** | **Description** |
| 0 | 1 Byte | SINT | System Status Byte 0-See Detail Below |
| 1 | 1 Byte | SINT | Handshake word |
| 2 | 1 Byte | SINT | Station 1 Status Byte 0-See Detail Below |
| 3 | 1 Byte | SINT | Reserved |
| 4, 5 | 2 Byte | INT | Station 1 Active Recipe (1-250), 0 = No Recipe Loaded |
| 6 | 1 Byte | SINT | Station 2 Status Byte 0-See Detail Below |
| 7 | 1 Byte | SINT | Reserved |
| 8, 9 | 2 Byte | INT | Station 2 Active Recipe (1-250), 0 = No Recipe Loaded |
| 10 | 1 Byte | SINT | Station 3 Status Byte 0-See Detail Below |
| 11 | 1 Byte | SINT | Reserved |
| 12, 13 | 2 Byte | INT | Station 3 Active Recipe (1-250), 0 = No Recipe Loaded |
| 14 | 1 Byte | SINT | Station 4 Status Byte 0-See Detail Below |
| 15 | 1 Byte | SINT | Reserved |
| 16, 17 | 2 Byte | INT | Station 4 Active Recipe (1-250), 0 = No Recipe Loaded |
| 18, 19 | - | - | Reserved |
| 20 | 1 Byte | SINT | Gun/Mix ID (Status Data cycled) |
| 21 | 1 Byte | SINT | Selected Gun/Mix Status Byte (See Below) |
| 22 | 1 Byte | SINT | Reserved |
| 23, 26 | 4 Byte | REAL | Selected Gun/Mix Total Flow |
| 27, 30 | 4 Byte | REAL | Selected Gun/Mix Component A Flow |
| 31, 34 | 4 Byte | REAL | Selected Gun/Mix Component B Flow |
| 35, 38 | 4 Byte | REAL | Selected Gun/Mix Component C Flow |
| 39, 42 | 4 Byte | REAL | Selected Gun/Mix Actual Ratio A |
| 43, 46 | 4 Byte | REAL | Selected Gun/Mix Actual Ratio B |
| 47, 50 | 4 Byte | REAL | Selected Gun/Mix Actual Ratio C |
| 51, 79 | - | - | Reserved |
| 80 | 1 Byte | SINT | Channel ID (Status Data cycled) |
| 82 | 1 Byte | SINT | Selected Channel Status Word 1 (see table below) |
| 83 | 1 Byte | SINT | Selected Channel Status Word 2 (see table below) |
| 84, 87 | 4 Byte | REAL | Selected Channel Inlet Pressure |
| 88, 91 | 4 Byte | REAL | Selected Channel Outlet Pressure |
| 92, 95 | 4 Byte | REAL | Selected Channel Actual Flow |
| 96, 99 | 4 Byte | REAL | Selected Channel Flow Command |
| 100, 103 | 4 Byte | REAL | Selected Channel Inlet Pressure Pilot |
| 104, 107 | 4 Byte | REAL | Selected Channel Flow Pilot Signal |
| 108, 111 | 4 Byte | REAL | Selected Channel Motor RPM (Future) |

| RF2 OUTPUT ARRAY 1-SINT 496 (cont.) | | | |
|---|---|---|---|
| **Address** | **Length** | **Datatype** | **Description** |
| 112, 115 | 4 Byte | REAL | Selected Channel Pulse Rate (Future) |
| 116, 159 | - | - | Reserved |
| 160, 161 | 2 Byte | INT | Read Data Register #1-ID Echo |
| 162, 163 | 2 Byte | INT | Read Data Register #2-ID Echo |
| 164, 165 | 2 Byte | INT | Read Data Register #3-ID Echo |
| 166, 167 | 2 Byte | INT | Read Data Register #4-ID Echo |
| 168, 169 | 2 Byte | INT | Read Data Register #5-ID Echo |
| 170, 171 | 2 Byte | INT | Read Data Register #6-ID Echo |
| 172, 173 | 2 Byte | INT | Read Data Register #7-ID Echo |
| 174, 175 | 2 Byte | INT | Read Data Register #8-ID Echo |
| 176, 177 | 2 Byte | INT | Read Data Register #9-ID Echo |
| 178, 179 | 2 Byte | INT | Read Data Register #10-ID Echo |
| 180, 199 | - | - | Reserved |
| 200, 203 | 4 Byte | DINT/REAL | Read Data Register #1 |
| 204, 207 | 4 Byte | DINT/REAL | Read Data Register #2 |
| 208, 211 | 4 Byte | DINT/REAL | Read Data Register #3 |
| 212, 215 | 4 Byte | DINT/REAL | Read Data Register #4 |
| 216, 219 | 4 Byte | DINT/REAL | Read Data Register #5 |
| 220, 223 | 4 Byte | DINT/REAL | Read Data Register #6 |
| 224, 227 | 4 Byte | DINT/REAL | Read Data Register #7 |
| 228, 231 | 4 Byte | DINT/REAL | Read Data Register #8 |
| 232, 235 | 4 Byte | DINT/REAL | Read Data Register #9 |
| 236, 239 | 4 Byte | DINT/REAL | Read Data Register #10 |
| 240, 279 | - | - | Reserved |
| 280 | 1 Byte | SINT | Alarm Word 0-Byte 0 |
| 281 | 1 Byte | SINT | Alarm Word 0-Byte 1 |
| 282 | 1 Byte | SINT | Alarm Word 0-Byte 2 |
| 283 | 1 Byte | SINT | Alarm Word 0-Byte 3 |
| 284 | 1 Byte | SINT | Alarm Word 1-Byte 0 |
| 285 | 1 Byte | SINT | Alarm Word 1-Byte 1 |
| 286 | 1 Byte | SINT | Alarm Word 1-Byte 2 |
| 287 | 1 Byte | SINT | Alarm Word 1-Byte 3 |
| 288 | 1 Byte | SINT | Alarm Word 2-Byte 0 |
| 289 | 1 Byte | SINT | Alarm Word 2-Byte 1 |
| 290 | 1 Byte | SINT | Alarm Word 2-Byte 2 |
| 291 | 1 Byte | SINT | Alarm Word 2-Byte 3 |

| RF2 OUTPUT ARRAY 1-SINT 496 (cont.) | | | |
|---|---|---|---|
| **Address** | **Length** | **Datatype** | **Description** |
| 292 | 1 Byte | SINT | Alarm Word 3-Byte 0 |
| 293 | 1 Byte | SINT | Alarm Word 3-Byte 1 |
| 294 | 1 Byte | SINT | Alarm Word 3-Byte 2 |
| 295 | 1 Byte | SINT | Alarm Word 3-Byte 3 |
| 296 | 1 Byte | SINT | Alarm Word 4-Byte 0 |
| 297 | 1 Byte | SINT | Alarm Word 4-Byte 1 |
| 298 | 1 Byte | SINT | Alarm Word 4-Byte 2 |
| 299 | 1 Byte | SINT | Alarm Word 4-Byte 3 |
| 300 | 1 Byte | SINT | Alarm Word 5-Byte 0 |
| 301 | 1 Byte | SINT | Alarm Word 5-Byte 1 |
| 302 | 1 Byte | SINT | Alarm Word 5-Byte 2 |
| 303 | 1 Byte | SINT | Alarm Word 5-Byte 3 |
| 304 | 1 Byte | SINT | Alarm Word 6-Byte 0 |
| 305 | 1 Byte | SINT | Alarm Word 6-Byte 1 |
| 306 | 1 Byte | SINT | Alarm Word 6-Byte 2 |
| 307 | 1 Byte | SINT | Alarm Word 6-Byte 3 |
| 308 | 1 Byte | SINT | Alarm Word 7-Byte 0 |
| 309 | 1 Byte | SINT | Alarm Word 7-Byte 1 |
| 310 | 1 Byte | SINT | Alarm Word 7-Byte 2 |
| 311 | 1 Byte | SINT | Alarm Word 7-Byte 3 |
| 312 | 1 Byte | SINT | Alarm Word 8-Byte 0 |
| 313 | 1 Byte | SINT | Alarm Word 8-Byte 1 |
| 314 | 1 Byte | SINT | Alarm Word 8-Byte 2 |
| 315 | 1 Byte | SINT | Alarm Word 8-Byte 3 |
| 316 | 1 Byte | SINT | Alarm Word 9-Byte 0 |
| 317 | 1 Byte | SINT | Alarm Word 9-Byte 1 |
| 318 | 1 Byte | SINT | Alarm Word 9-Byte 2 |
| 319 | 1 Byte | SINT | Alarm Word 9-Byte 3 |
| 320..336 | - | - | Reserved |
| 337 | 1 Byte | SINT | Fluid Usage Data-Gun Selected Echo |
| 338 | 1 Byte | SINT | Fluid Usage Data-Time Range Echo |
| 339, 340 | 2 Byte | INT | Fluid Usage Data-Job Select Echo |
| 341..344 | 4 Byte | Real | Fluid Usage Data-Selected Data-Mat. A |
| 345..348 | 4 Byte | Real | Fluid Usage Data-Selected Data-Mat. B |

| RF2 OUTPUT ARRAY 1-SINT 496 (cont.) | | | |
|---|---|---|---|
| **Address** | **Length** | **Datatype** | **Description** |
| 349..352 | 4 Byte | Real | Fluid Usage Data-Selected Data-Mat. C |
| 353..356 | 4 Byte | Real | Fluid Usage Data-Selected Data-Mat. Total |
| 357..360 | 4 Byte | Real | Fluid Usage Data-Selected Data-Clean |
| 361..495 | 133 Byte | - | Reserved |

| SYSTEM STATUS BYTE 0 (WORD 0) | | | |
|---|---|---|---|
| **Address** | **Length** | **Datatype** | **Description** |
| 0.0 | 1 Bit | Bool | Comm Heartbeat |
| 0.1 | 1 Bit | Bool | Fault Exists |
| 0.2 | 1 Bit | Bool | Data Stable (Mix/Channel Status Data Stable) |
| 0.3 | 1 Bit | Bool | Spare |
| 0.4 | 1 Bit | Bool | Spare |
| 0.5 | 1 Bit | Bool | Spare |
| 0.6 | 1 Bit | Bool | Spare |
| 0.7 | 1 Bit | Bool | Spare |

| SYSTEM STATUS BYTE 0 (WORD 2,6,10,14) | | | |
|---|---|---|---|
| **Address** | **Length** | **Datatype** | **Description** |
| 0.0 | 1 Bit | Bool | Run Mode |
| 0.1 | 1 Bit | Bool | Spare |
| 0.2 | 1 Bit | Bool | Fluid Sequence Active |
| 0.3 | 1 Bit | Bool | HV Enable |
| 0.4 | 1 Bit | Bool | Spare |
| 0.5 | 1 Bit | Bool | Spare |
| 0.6 | 1 Bit | Bool | Spare |
| 0.7 | 1 Bit | Bool | Spare |

| GUN/MIXER STATUS BYTE (WORD 21-MIXER DATA FROM WORD 20) | | | |
|---|---|---|---|
| **Address** | **Length** | **Datatype** | **Description** |
| 0.0 | 1 Bit | Bool | Trigger 1 |
| 0.1 | 1 Bit | Bool | Trigger 2 |
| 0.2 | 1 Bit | Bool | Trigger 3 |
| 0.3 | 1 Bit | Bool | Trigger 4 |
| 0.4 | 1 Bit | Bool | Spare |
| 0.5 | 1 Bit | Bool | Pot Life Expired |
| 0.6 | 1 Bit | Bool | Warning |
| 0.7 | 1 Bit | Bool | Spray Shutdown |

| CHANNEL STATUS BYTE 0 (WORD 82-CHANNEL DATA FROM WORD 80) | | | |
|---|---|---|---|
| **Address** | **Length** | **Datatype** | **Description** |
| 0.0 | 1 Bit | Bool | Flow Started |
| 0.1 | 1 Bit | Bool | Calibration Active |
| 0.2 | 1 Bit | Bool | Manual Override Active |
| 0.3 | 1 Bit | Bool | Spare |
| 0.4 | 1 Bit | Bool | Spare |
| 0.5 | 1 Bit | Bool | Spare |
| 0.6 | 1 Bit | Bool | Spare |
| 0.7 | 1 Bit | Bool | Spare |

The RF2 Communications arrays represent the following Data

## Communications via AnyBus gateway

If purchased, the RF2 may come equipped with an AnyBus gateway which uses Ethernet/IP on the RF2 network, and a protocol of the customer's choosing on its secondary network. It is also possible to add the gateway at a later time. This gateway connects implicitly to both networks and transfers 496 bytes of input data and 496 bytes of output data between the networks. When using the gateway, the arrays listed in the section below are mapped into the AnyBus tag addresses.

Programming must be done on the side of the customer to copy the data into the correct registers. The input and output sizes in the customer's network must be 496 bytes each. See user manual for the specific model of AnyBus gateway provided for more information on programming it.

# SCHEMATICS

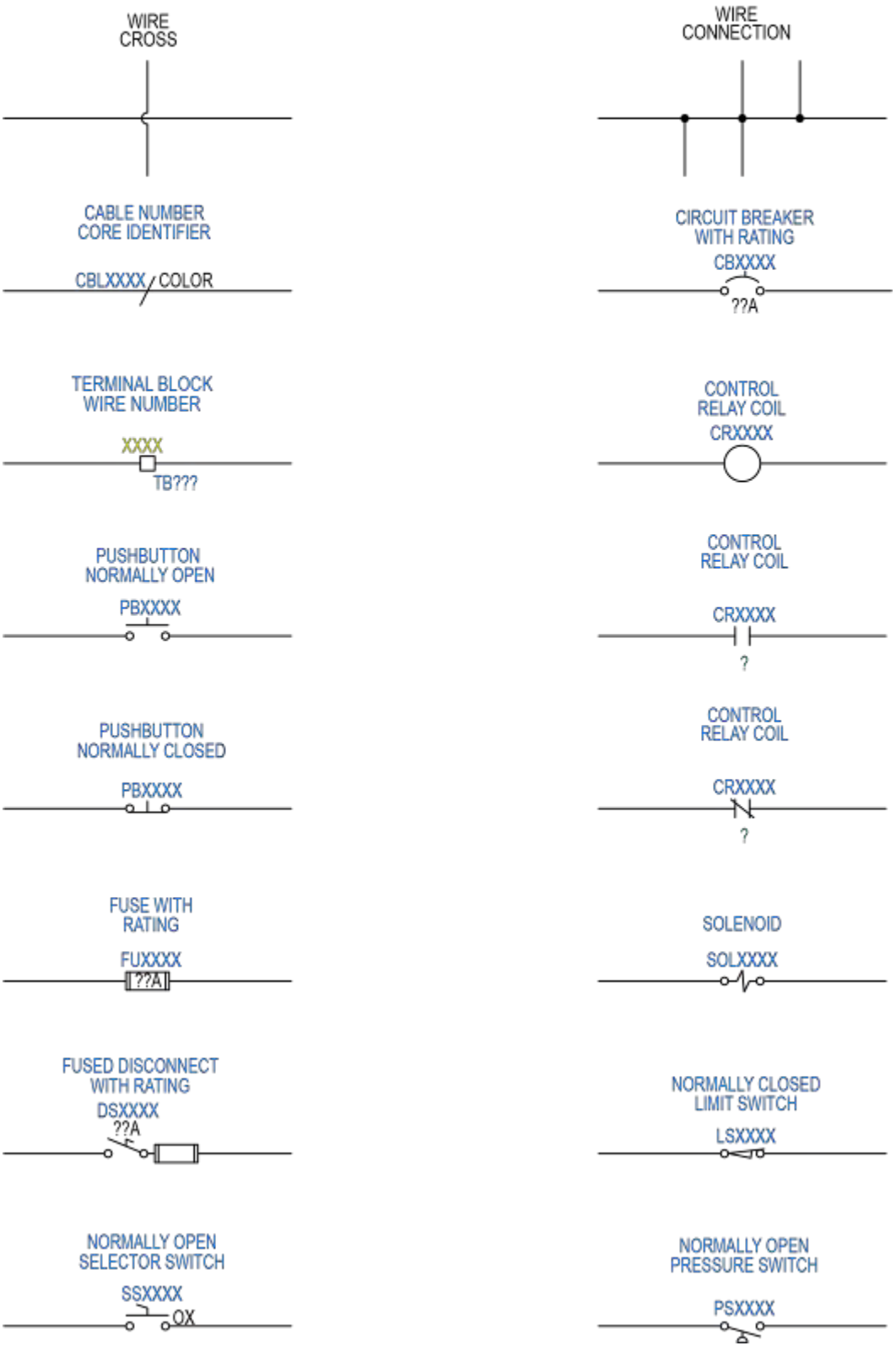
## TABLE OF CONTENTS

## REVISION LIST

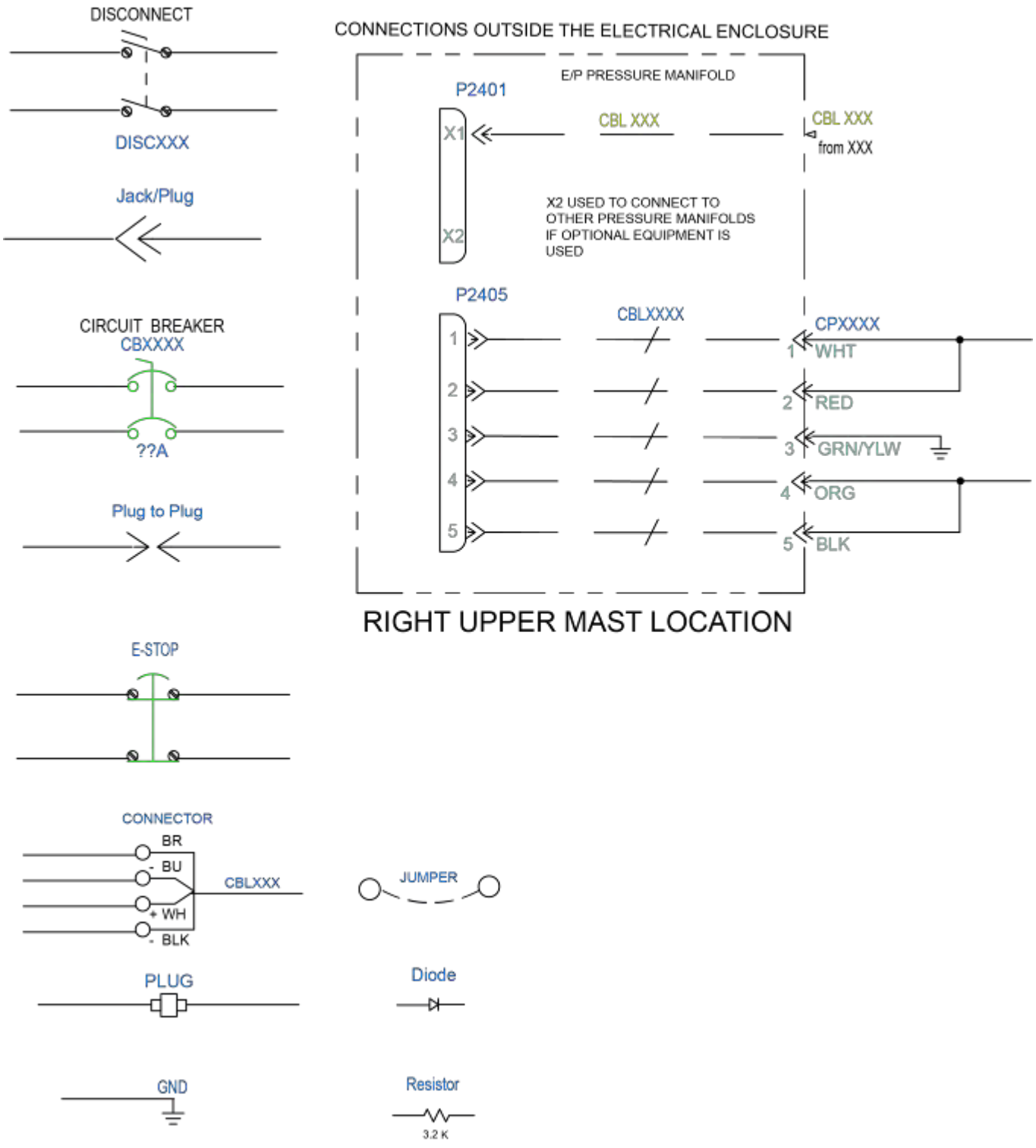
| REVISION LIST | | | |
|---|---|---|---|
| **Version** | **Engineer** | **Date** | **Description** |
| A | SA | 06/01/2020 | DESIGN |
| B | JV | 12/10/2020 | AS BUILT-ALPHA |
| C | JV | 01/25/2021 | DESIGN UPDATES |
| D | JV | 05/26/2021 | PRE-PRODUCTION UPDATES |
| E | JV | 07/27/2021 | UPDATES AFTER EMC TESTING |
| F | JV | 08/23/2021 | AFTER FIRST BETA TEST |
| 1 | JV | 02/03/2022 | PRODUCTION RELEASE |
| J | RDH | 02/13/2023 | UPDATES |

**PRELIMINARY 1**

LEGEND DESCRIPTIONS
NUMBERING CODE
XX???? = COMPONENT TYPE
??XX?? = SHEET
????XX = COLUMN



## PRELIMINARY 1 (cont.)



## PRELIMINARY 2

| WIRE COLORS | |
|---|---|
| **Wire Reference** | **Color** |
| BLK | BLACK |
| WHT | WHITE |
| BLU | BLUE |
| RED | RED |
| GRN | GREEN |
| ORG | ORANGE |
| BRN | BROWN |
| YLW | YELLOW |

| FERRULES TO BE USED ON ALL WIRES (UNLESS NOTED) | |
|---|---|
| **Wire Reference** | **Description** |
| BLACK | UNGROUNDED LINE VOLTAGE |
| WHITE | UNGROUNDED DC VOLTAGE |
| WHITE/BLUE | GROUNDED DC COMMON |
| GREEN/YELLOW | GROUND |

| WIRE COLORS | |
|---|---|
| **Wire Reference** | **Color** |
| RED_GRY | RED w/GRAY STRIPE |
| GRY_RED | GRAY w/RED STRIPE |
| WHT_BRN | WHITE w/BROWN STRIPE |
| BRN_WHT | BROWN w/WHITE STRIP |
| WHT_GRY | WHITE w/GRAY STRIPE |
| GRY_WHT | GRAY w/WHITE STRIPE |
| RED_BLU | RED w/BLUE STRIPE |
| BLU_RED | BLUE w/RED STRIPE |
| RED_ORG | RED w/ORANGE STRIPE |
| ORG_RED | ORANGE w/RED STRIPE |
| RED_GRN | RED w/GREEN STRIPE |
| GRN_RED | GREEN w/RED STRIPE |
| BRN_RED | BROWN w/RED STRIPE |
| RED_BRN | RED w/BROWN STRIPE |
| WHT_GRN | WHITE w/GREEN STRIPE |
| GRN_WHT | GREEN w/WHITE STRIPE |
| WHT_BLU | WHITE w/BLUE STRIPE |
| BLU_WHT | BLUE w/ WHITE STRIPE |

## PRELIMINARY 2 (cont.)

| WIRE COLORS (CONT.) | |
|---|---|
| **Wire Reference** | **Color** |
| WHT_ORG | WHITE w/ORANGE STRIPE |
| ORG_WHT | ORANGE w/WHITE STRIPE |
| GRN_YLW | GREEN w/YELLOW STRIPE |

## PRELIMINARY 3

| WIRE GAUGE (UNLESS NOTED) USE MIN 75 DEGREE C COPPER WIRE | | | |
|---|---|---|---|
| **American Wire Gauge (AWG)** | **Diameter (Inches)** | **Cross Sectional Area ($mm^2$)** | **Ampacity (75° C Copper)** |
| 3 | 0.2292 | 26.65 | 100 |
| 4 | 0.2043 | 21.14 | 85 |
| 6 | 0.162 | 13.29 | 65 |
| 8 | 0.1285 | 8.36 | 52 |
| 10 | 0.1019 | 5.26 | 30 |
| 12 | 0.0808 | 3.31 | 20 |
| 14 | 0.0641 | 2.08 | 15 |
| 16 | 0.0508 | 1.31 | 10 |
| 18 | 0.0403 | 0.82 | 7 |

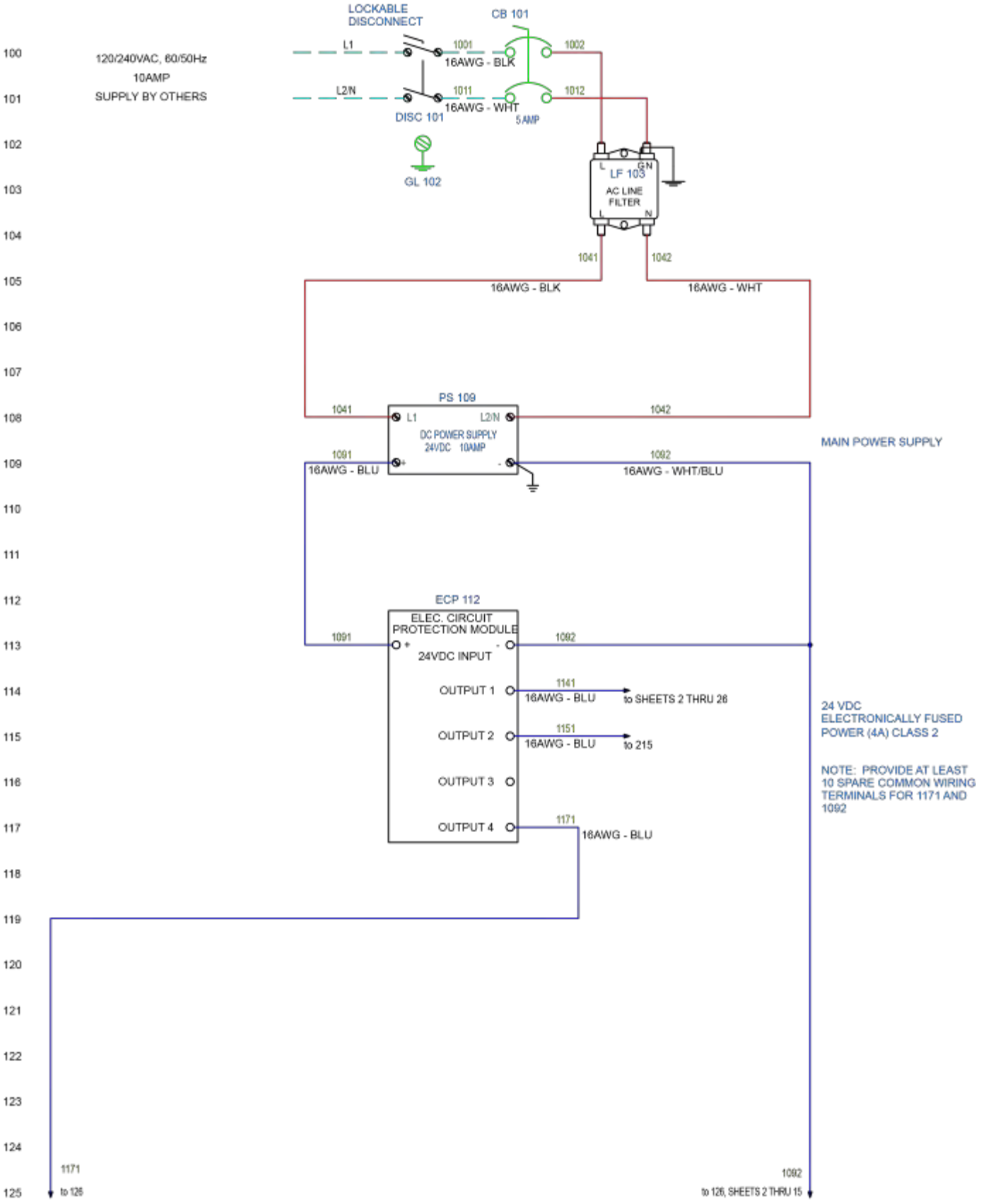
**PRELIMINARY 4**

# RESERVED FOR IEC DOCUMENTATION

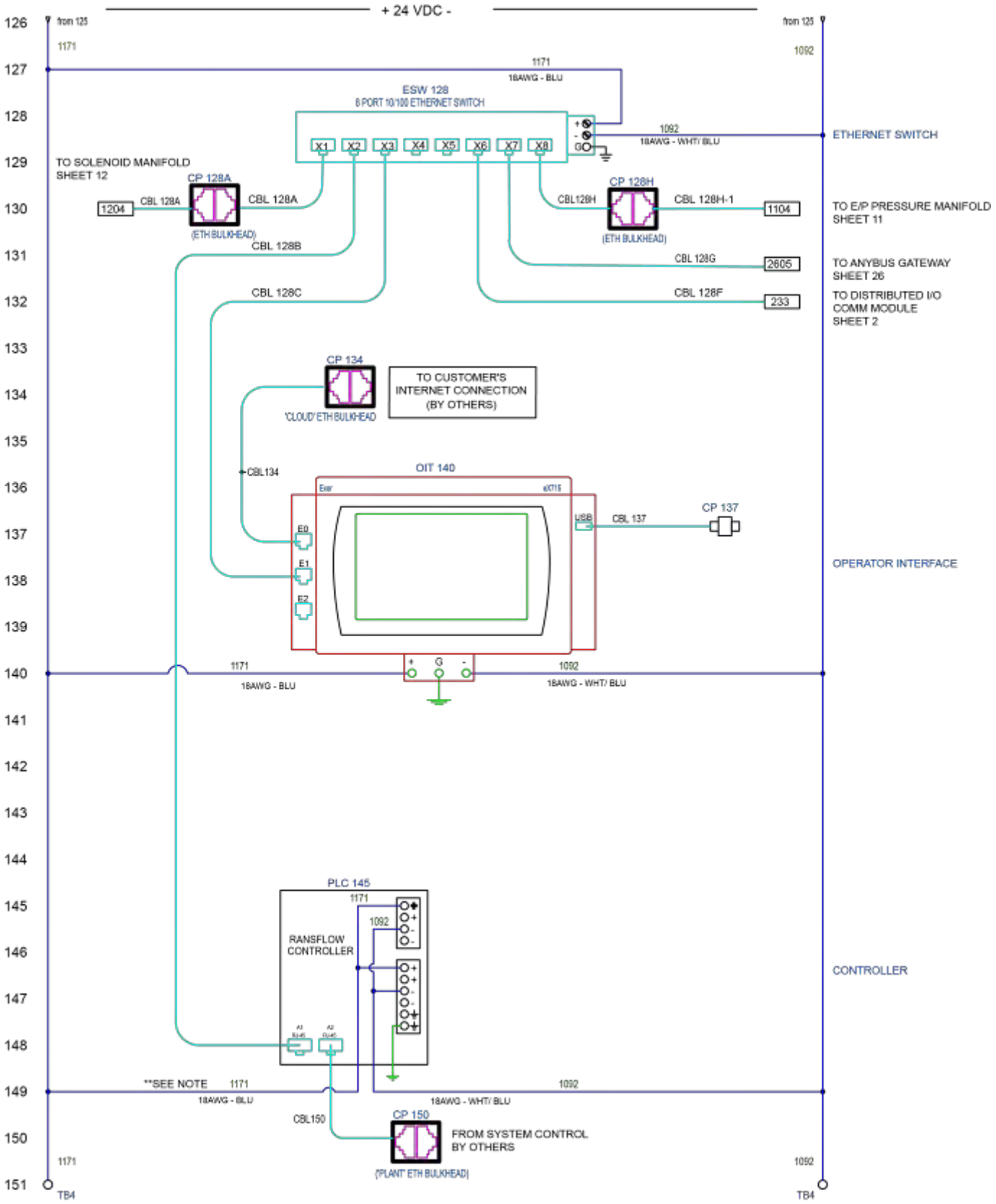
## PRELIMINARY 5

| CABLE LIST | | | |
|---|---|---|---|
| **Cable** | **Cable Type** | **Part** | **Location** |
| CBL 128A | ETHERNET 3FT | 310-4135 | ETHERNET SWITCH X1 TO BULKHEAD |
| CBL 128A-1 | ETHERNET RJ45-M11-90, 1M | 310-4136 | BULKHEAD CP128 TO E/P PRESSURE MANIFOLD X1 |
| CBL 128B | ETHERNET 3FT | 310-4135 | ETHERNET SWITCH X2 TO PLC A1 |
| CBL 128C | ETHERNET 5FT | 310-3134 | ETHERNET SWITCH X3 TO HMI E1 |
| CBL 128F | ETHERNET 3FT | 310-4135 | ETHERNET SWITCH X6 TO RIO230 (TURCK I/O) ETH1 |
| CBL 128G | ETHERNET 3FT | 310-4135 | ETHERNET SWITCH TO ANYBUS GATEWAY X1.1 |
| CBL 128H | ETHERNET 5FT | 310-4134 | ETHERNET SWITCH X8 TO BULKHEAD CP128H |
| CBL 128H-1 | ETHERNET RJ45-M11-90, 1M | 310-4136 | BULKHEAD CP128H YO PRESSURE REGULATOR X1 |
| CBL 134 | ETHERNET 3FT | 310-4135 | HMI E0 TO BULKHEAD CP134 |
| CBL 137 | DUAL PORT USB, 1.5M | 09454521952 | HMI USB TO BULKHEAD/PLUG CP 137 |
| CBL 150 | ETHERNET 5FT | 310-4134 | PLC A2 TO BULKHEAD CP150 |
| CBL 629 | 7 COLOR STACK LIGHT w/AUDIB | 240-5160 | RIO234 SLOT 4 TO STACK LIGHT |
| CBL 1105 | BULKHEAD CONN; 7/8", 5 POLE | 310-4132 | BULKHEAD TO SOLM 1102 POWER |
| CBL 1203 | CAT 5E, M12, 1M | 310-4133 | SOLM 1203 TP2 TO SOLM 1207 TP1 (OPTIONAL) |
| CBL 1205-1 | M12 5 PIN, 0.3M, 9O° | 310-4148 | BULKHEAD CP1205 TO SOLM 1203 X0 |
| CBL 1207 | CAT 5E, M12, 1M | 310-4133 | SOLM 1207 TP2 TO SOLM 1212 TP1 (OPTIONAL) |
| CBL 1209-1 | BULKHEAD M12 5 PIN | 310-4130 | BULKHEAD 1204 TO SOLM 1207 X0 (OPTIONAL) |
| CBL 1212 | CAT 5E, M12, 1M | 310-4133 | SOLM 1212 TP2 TO SOLM 1217 TP1 (OPTIONAL) |
| CBL 1214-1 | BULKHEAD M12 5 PIN | 310-4130 | BULKHEAD 1214 TO SOLM 1212 X0 (OPTIONAL) |
| CBL 1219-1 | BULKHEAD M12 5 PIN | 310-4130 | BULKHEAD 1219 TO SOLM 1207 X0 (OPTIONAL) |
| CBL 2405-1 | MIN (7/8"), 5P, 2M, F-M | 310-4140 | BULKHEAD CP1105 TO SOLM 1102 P2405 |
| CBL 2609 | ETHERNET 3FT | 310-4135 | ANYBUS X2.1 TO BULKHEAD CP 2609 |

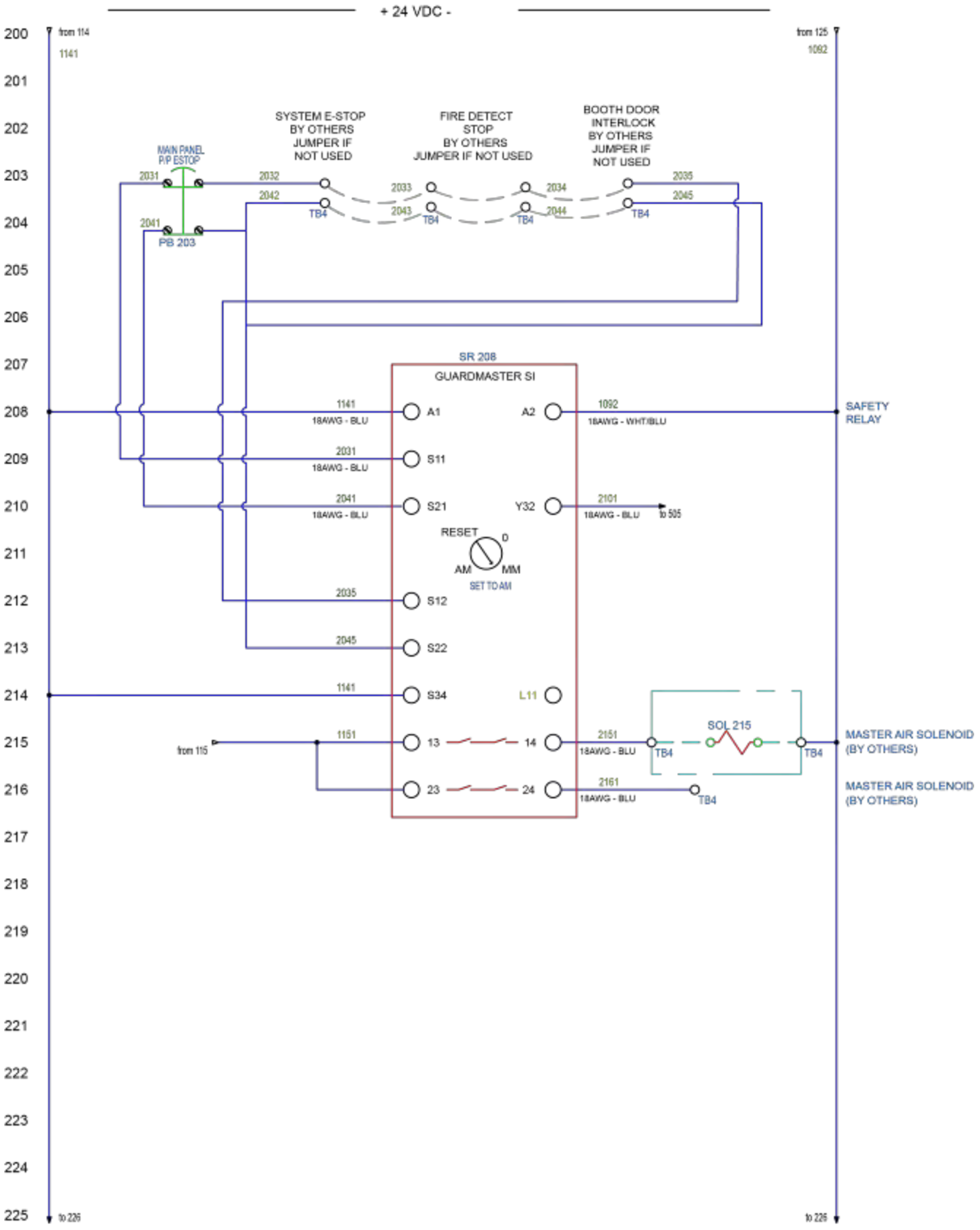
## DRAWING 1


LOCKABLE DISCONNECT
CB 101
120/240VAC, 60/50Hz
10AMP
SUPPLY BY OTHERS
L1
L2/N
1001
16AWG - BLK
1002
1011
16AWG - WHT
1012
DISC 101
5 AMP
GL 102
LF 103
AC LINE FILTER
L
G/N
N
1041
1042
16AWG - BLK
16AWG - WHT
PS 109
DC POWER SUPPLY
24VDC 10AMP
1091
16AWG - BLU
1092
16AWG - WHT/BLU
MAIN POWER SUPPLY
ECP 112
ELEC. CIRCUIT PROTECTION MODULE
24VDC INPUT
OUTPUT 1
OUTPUT 2
OUTPUT 3
OUTPUT 4
1141
16AWG - BLU
to SHEETS 2 THRU 26
1151
16AWG - BLU
to 215
1171
16AWG - BLU
24 VDC ELECTRONICALLY FUSED POWER (4A) CLASS 2
NOTE: PROVIDE AT LEAST 10 SPARE COMMON WIRING TERMINALS FOR 1171 AND 1092
1171
to 126
1092
to 126, SHEETS 2 THRU 15

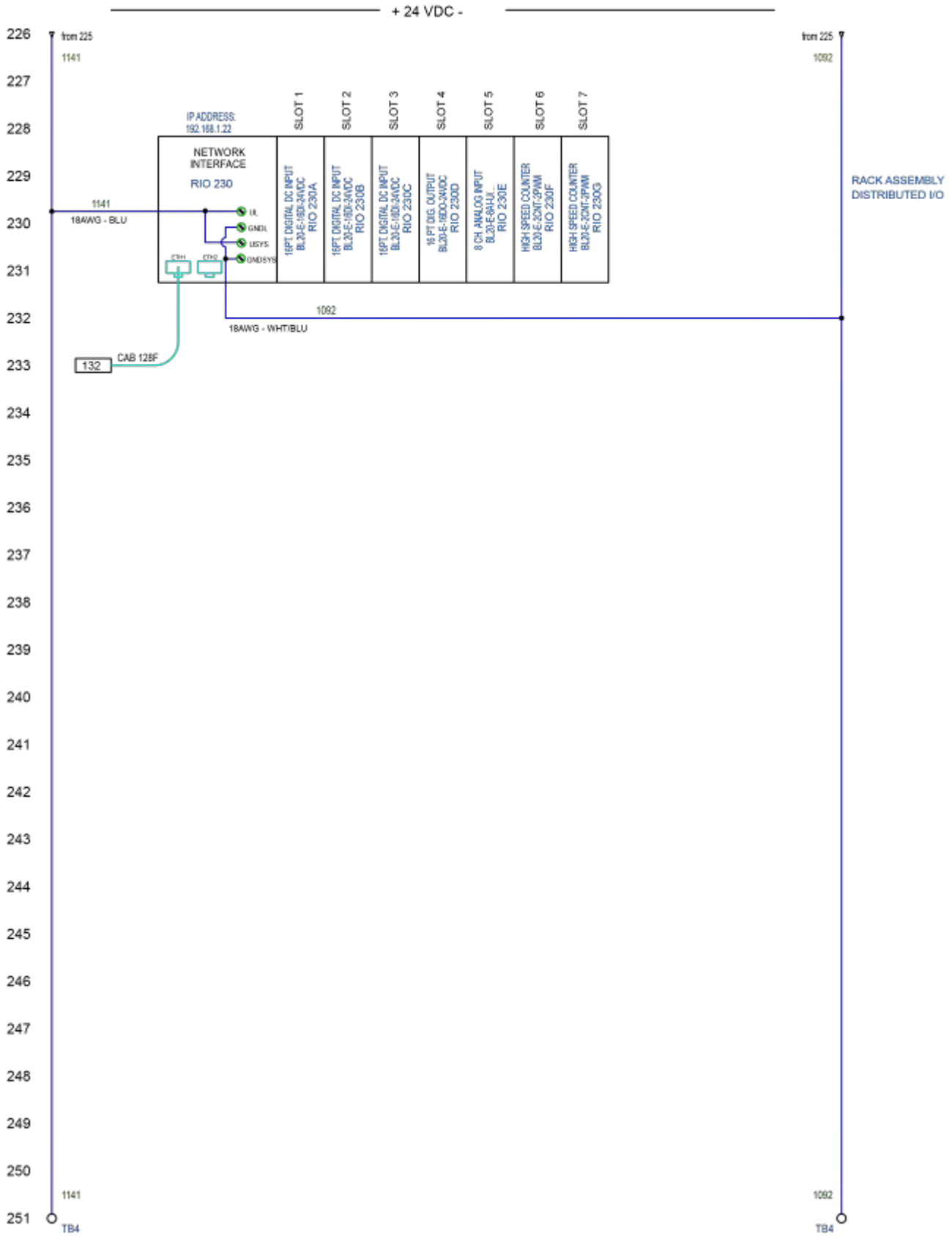
## DRAWING 1 (cont.)



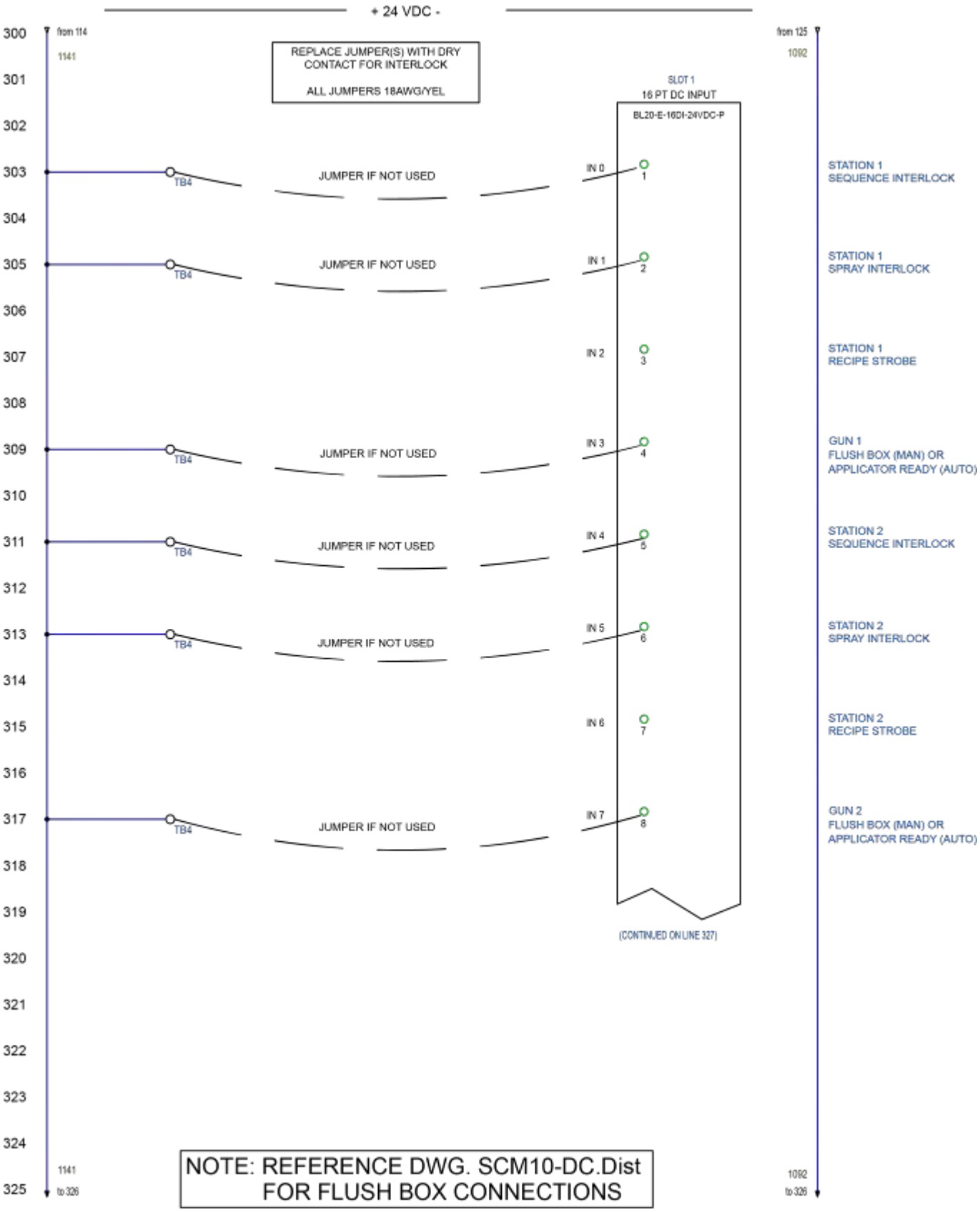
## DRAWING 2


+ 24 VDC -
from 114
1141
from 125
1092
SYSTEM E-STOP
BY OTHERS
JUMPER IF
NOT USED
FIRE DETECT
STOP
BY OTHERS
JUMPER IF NOT USED
BOOTH DOOR
INTERLOCK
BY OTHERS
JUMPER IF
NOT USED
MAIN PANEL
P/P ESTOP
2031
2032
2042
2033
2043
2034
2044
2035
2045
TB4
2041
PB 203
SR 208
GUARDMASTER SI
1141
18AWG - BLU
A1
A2
1092
18AWG - WHT/BLU
SAFETY
RELAY
2031
18AWG - BLU
S11
2041
18AWG - BLU
S21
Y32
2101
18AWG - BLU
to 505
RESET
D
AM
MM
SET TO AM
2035
S12
2045
S22
1141
S34
L11
from 115
1151
13
14
2151
18AWG - BLU
SOL 215
MASTER AIR SOLENOID
(BY OTHERS)
23
24
2161
18AWG - BLU
MASTER AIR SOLENOID
(BY OTHERS)
to 226
to 226

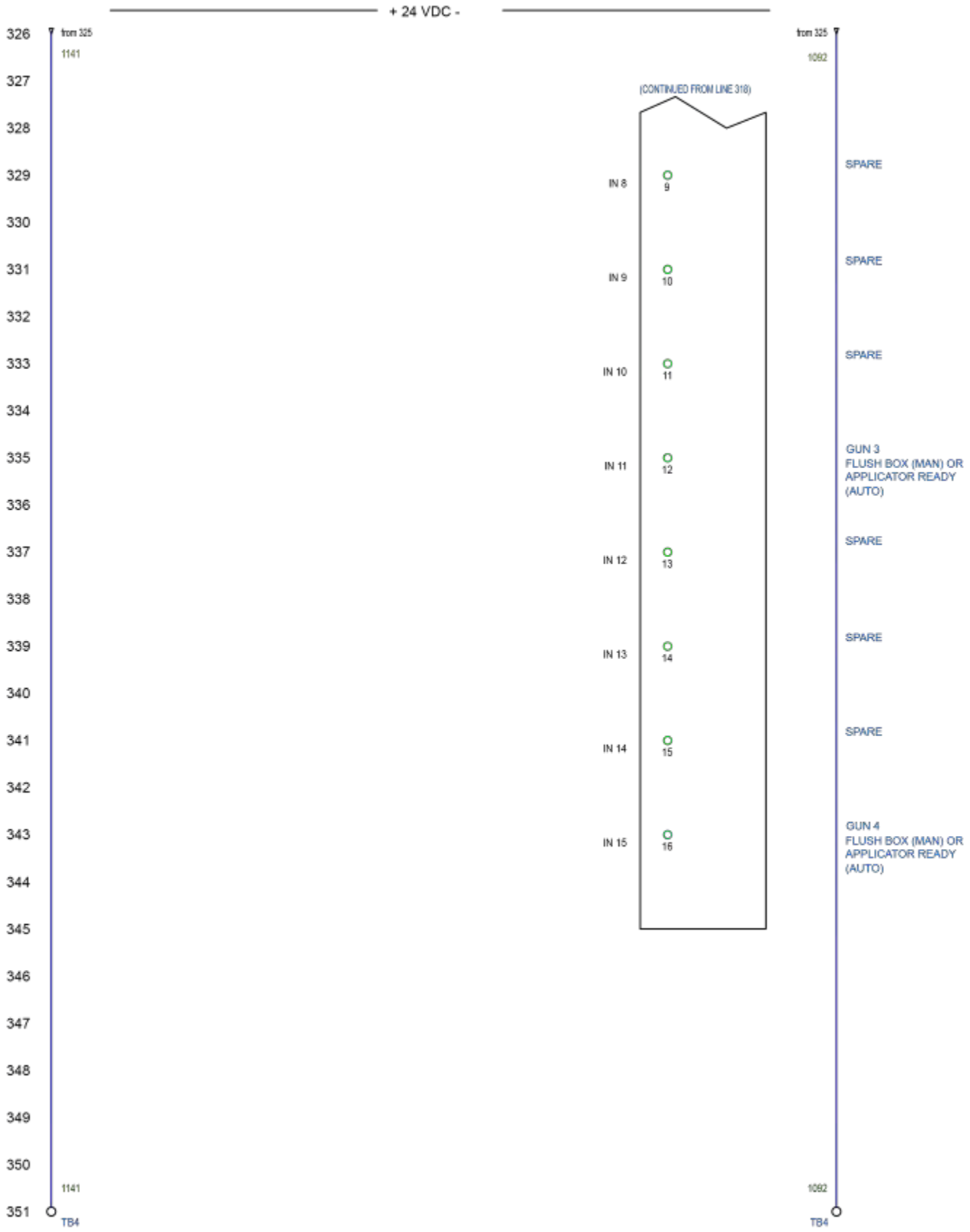
## DRAWING 2 (cont.)



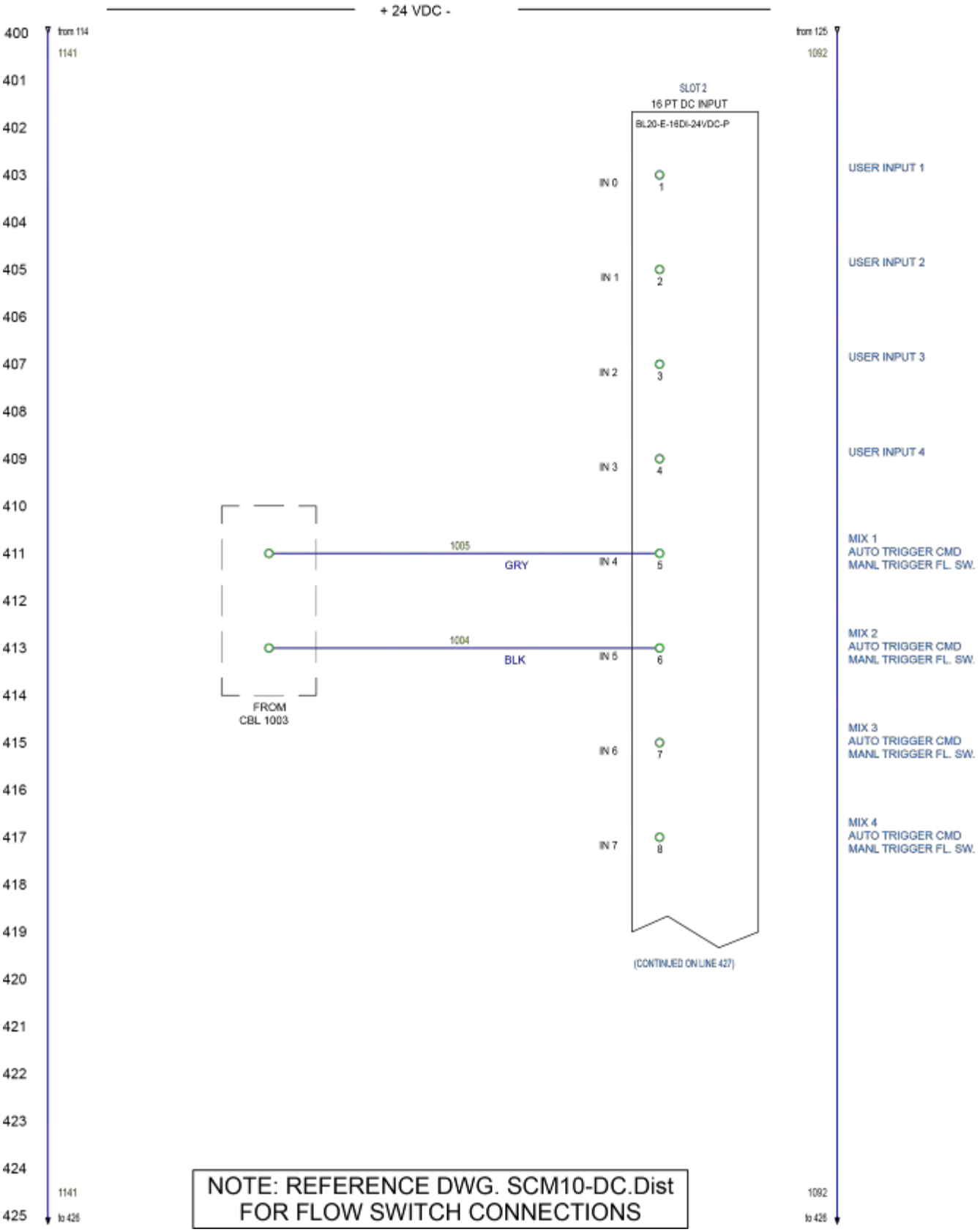
## DRAWING 3


+ 24 VDC -
from 114
1141
REPLACE JUMPER(S) WITH DRY CONTACT FOR INTERLOCK
ALL JUMPERS 18AWG/YEL
SLOT 1
16 PT DC INPUT
BL20-E-16DI-24VDC-P
JUMPER IF NOT USED
TB4
IN 0
IN 1
IN 2
IN 3
IN 4
IN 5
IN 6
IN 7
STATION 1 SEQUENCE INTERLOCK
STATION 1 SPRAY INTERLOCK
STATION 1 RECIPE STROBE
GUN 1 FLUSH BOX (MAN) OR APPLICATOR READY (AUTO)
STATION 2 SEQUENCE INTERLOCK
STATION 2 SPRAY INTERLOCK
STATION 2 RECIPE STROBE
GUN 2 FLUSH BOX (MAN) OR APPLICATOR READY (AUTO)
(CONTINUED ON LINE 327)
from 125
1092
1141
to 326
1092
to 326
NOTE: REFERENCE DWG. SCM10-DC.Dist FOR FLUSH BOX CONNECTIONS

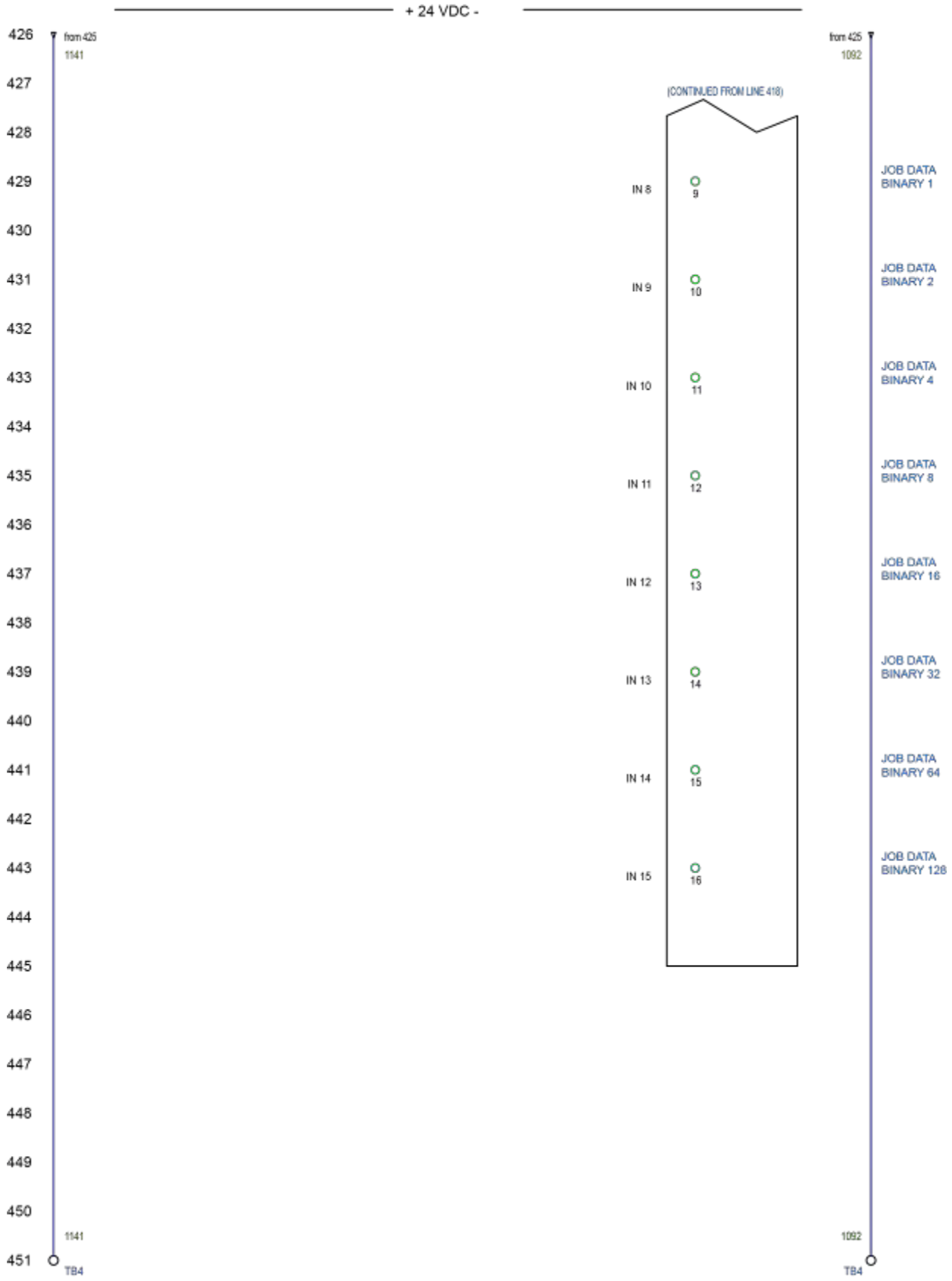
## DRAWING 3 (cont.)



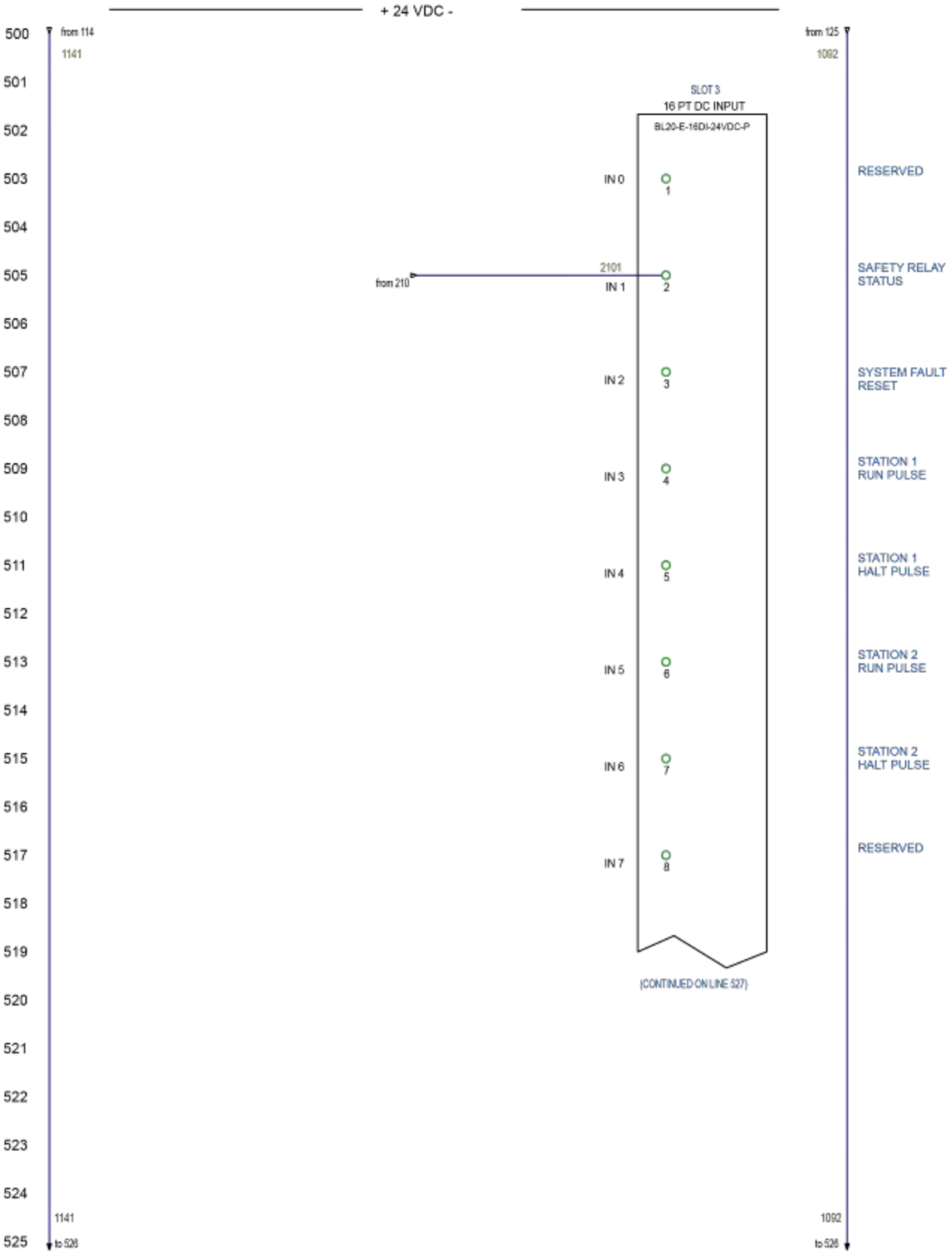
## DRAWING 4


+ 24 VDC -
400
401
402
403
404
405
406
407
408
409
410
411
412
413
414
415
416
417
418
419
420
421
422
423
424
425
from 114
1141
to 426
from 125
1092
to 426
SLOT 2
16 PT DC INPUT
BL20-E-16DI-24VDC-P
IN 0
1
IN 1
2
IN 2
3
IN 3
4
IN 4
5
IN 5
6
IN 6
7
IN 7
8
USER INPUT 1
USER INPUT 2
USER INPUT 3
USER INPUT 4
MIX 1
AUTO TRIGGER CMD
MANL TRIGGER FL. SW.
MIX 2
AUTO TRIGGER CMD
MANL TRIGGER FL. SW.
MIX 3
AUTO TRIGGER CMD
MANL TRIGGER FL. SW.
MIX 4
AUTO TRIGGER CMD
MANL TRIGGER FL. SW.
1005
GRY
1004
BLK
FROM
CBL 1003
(CONTINUED ON LINE 427)
NOTE: REFERENCE DWG. SCM10-DC.Dist
FOR FLOW SWITCH CONNECTIONS

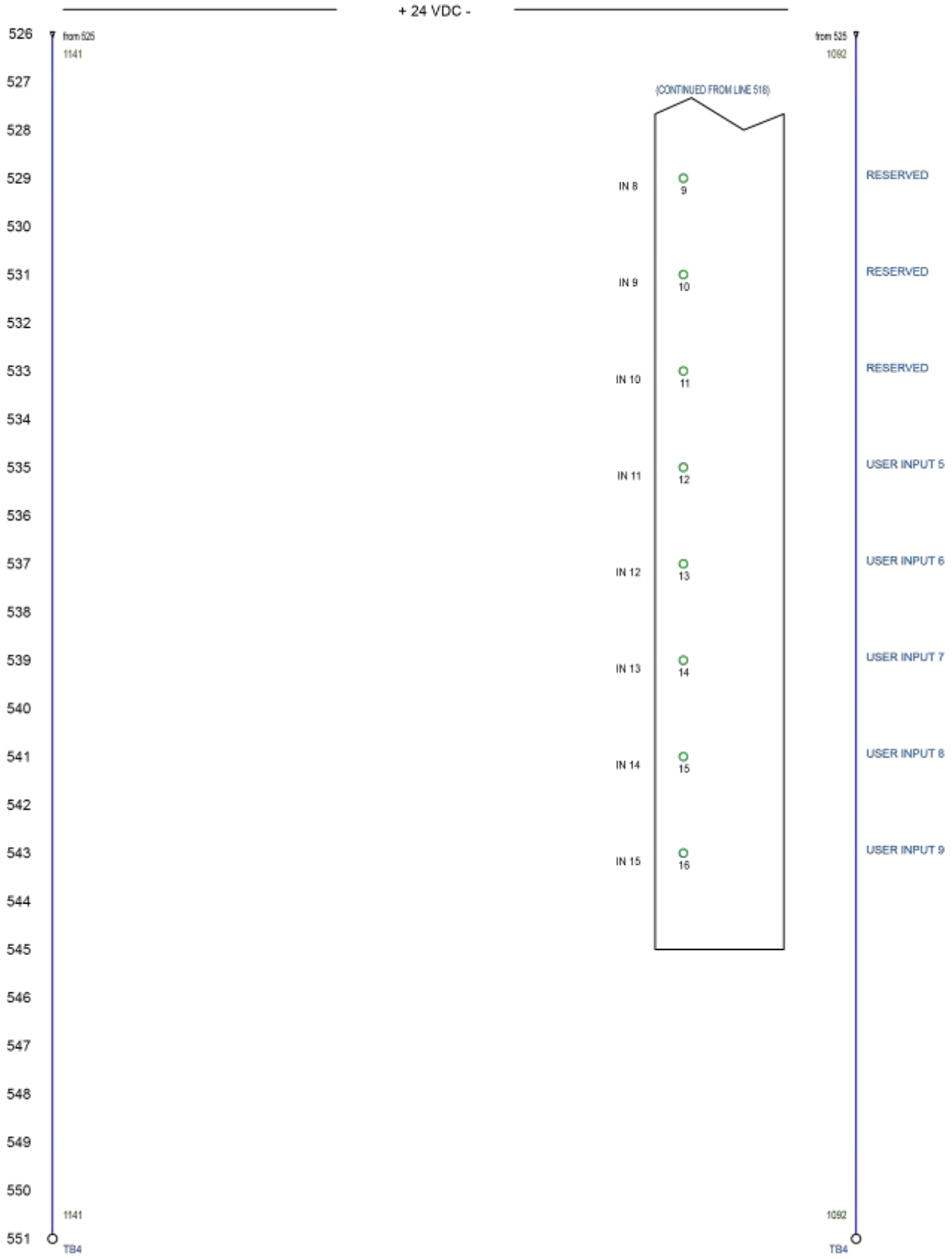
## DRAWING 4 (cont.)



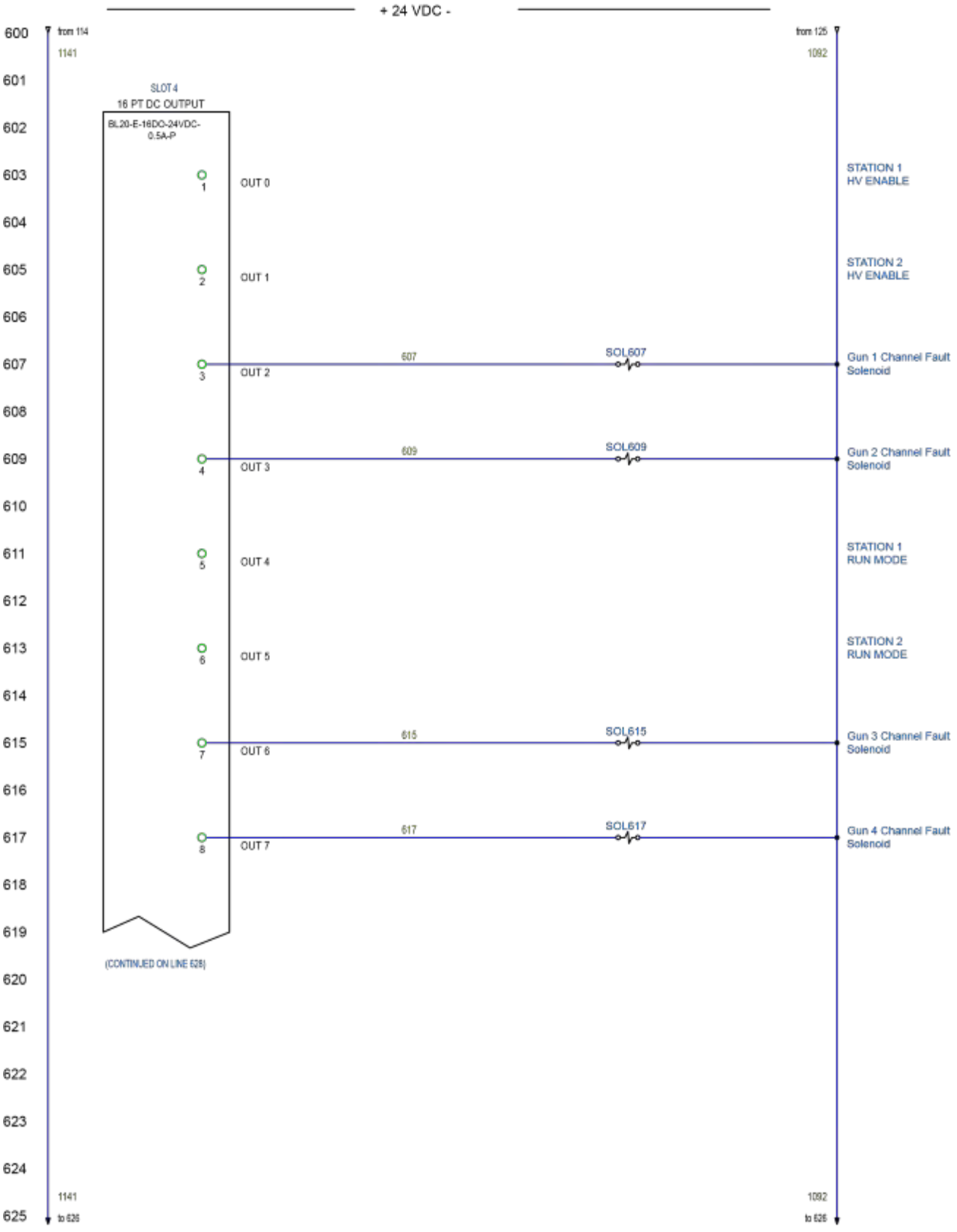
## DRAWING 5


+ 24 VDC -
from 114
1141
from 125
1092
SLOT 3
16 PT DC INPUT
BL20-E-16DI-24VDC-P
IN 0
1
RESERVED
2101
from 210
IN 1
2
SAFETY RELAY STATUS
IN 2
3
SYSTEM FAULT RESET
IN 3
4
STATION 1 RUN PULSE
IN 4
5
STATION 1 HALT PULSE
IN 5
6
STATION 2 RUN PULSE
IN 6
7
STATION 2 HALT PULSE
IN 7
8
RESERVED
(CONTINUED ON LINE 527)
1141
to 526
1092
to 526

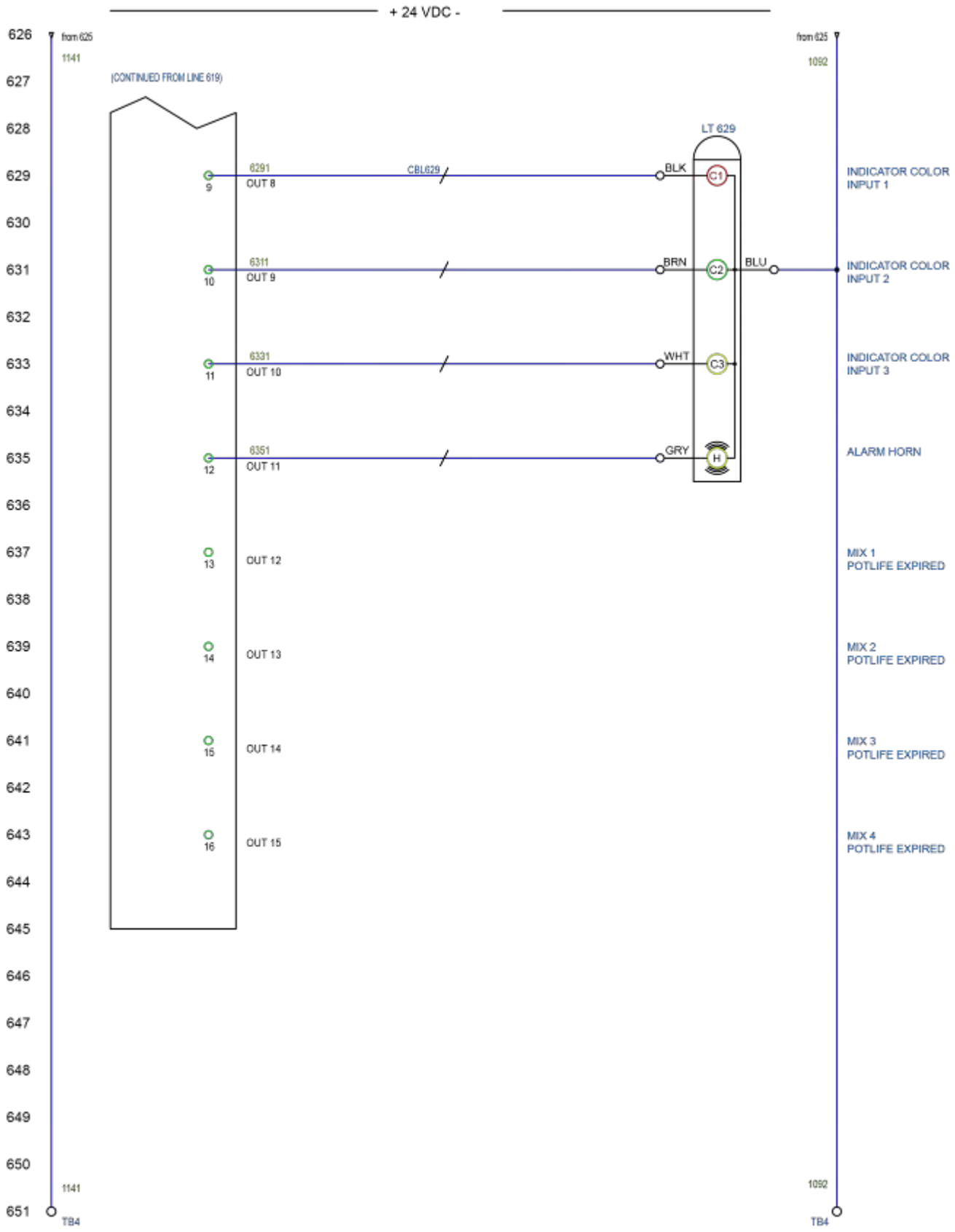
## DRAWING 5 (cont.)



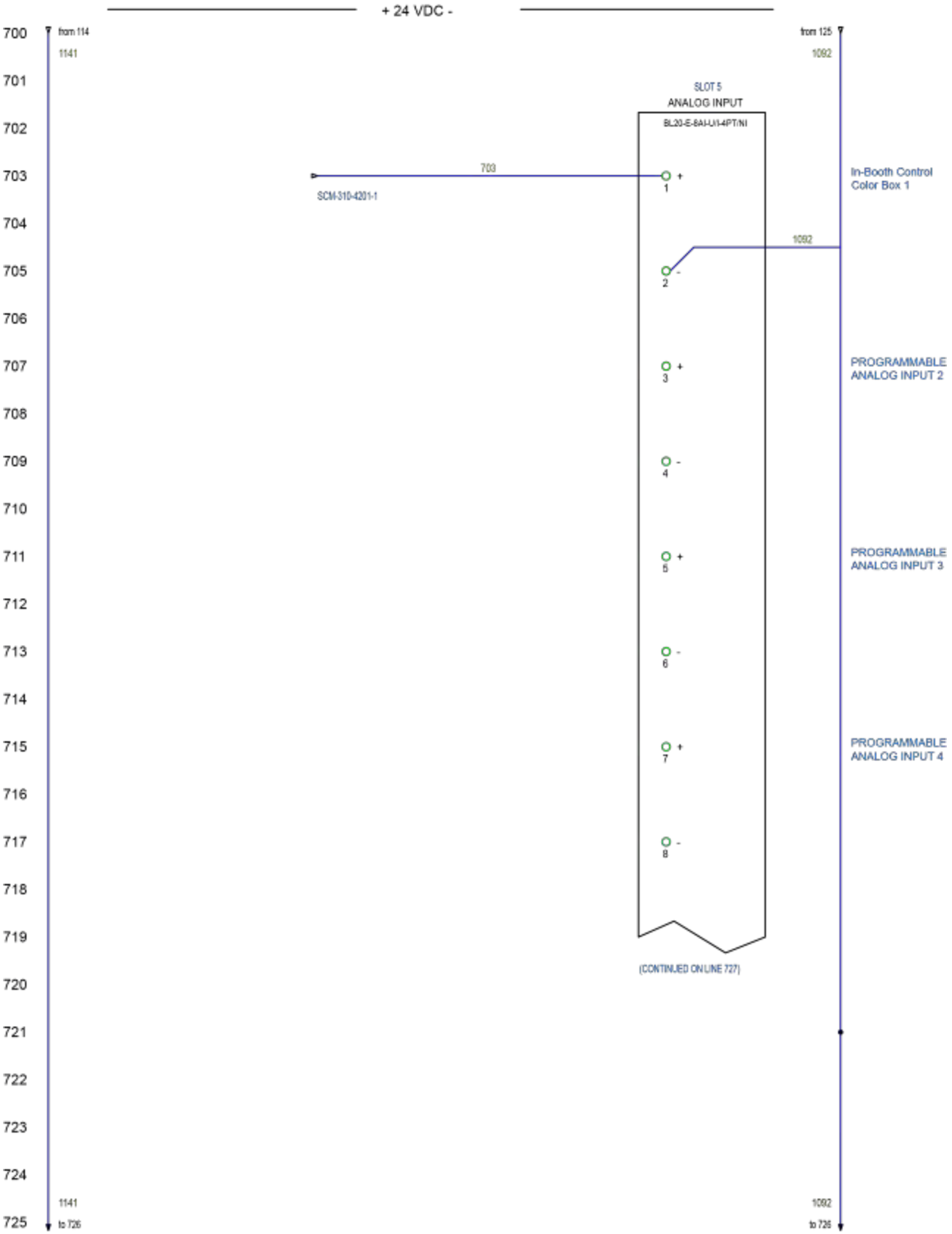
## DRAWING 6


+ 24 VDC -
600
601
602
603
604
605
606
607
608
609
610
611
612
613
614
615
616
617
618
619
620
621
622
623
624
625
from 114
1141
from 125
1092
SLOT 4
16 PT DC OUTPUT
BL20-E-16DO-24VDC-0.5A-P
1
OUT 0
2
OUT 1
3
OUT 2
4
OUT 3
5
OUT 4
6
OUT 5
7
OUT 6
8
OUT 7
607
609
615
617
SOL607
SOL609
SOL615
SOL617
STATION 1 HV ENABLE
STATION 2 HV ENABLE
Gun 1 Channel Fault Solenoid
Gun 2 Channel Fault Solenoid
STATION 1 RUN MODE
STATION 2 RUN MODE
Gun 3 Channel Fault Solenoid
Gun 4 Channel Fault Solenoid
(CONTINUED ON LINE 628)
1141
to 626
1092
to 626

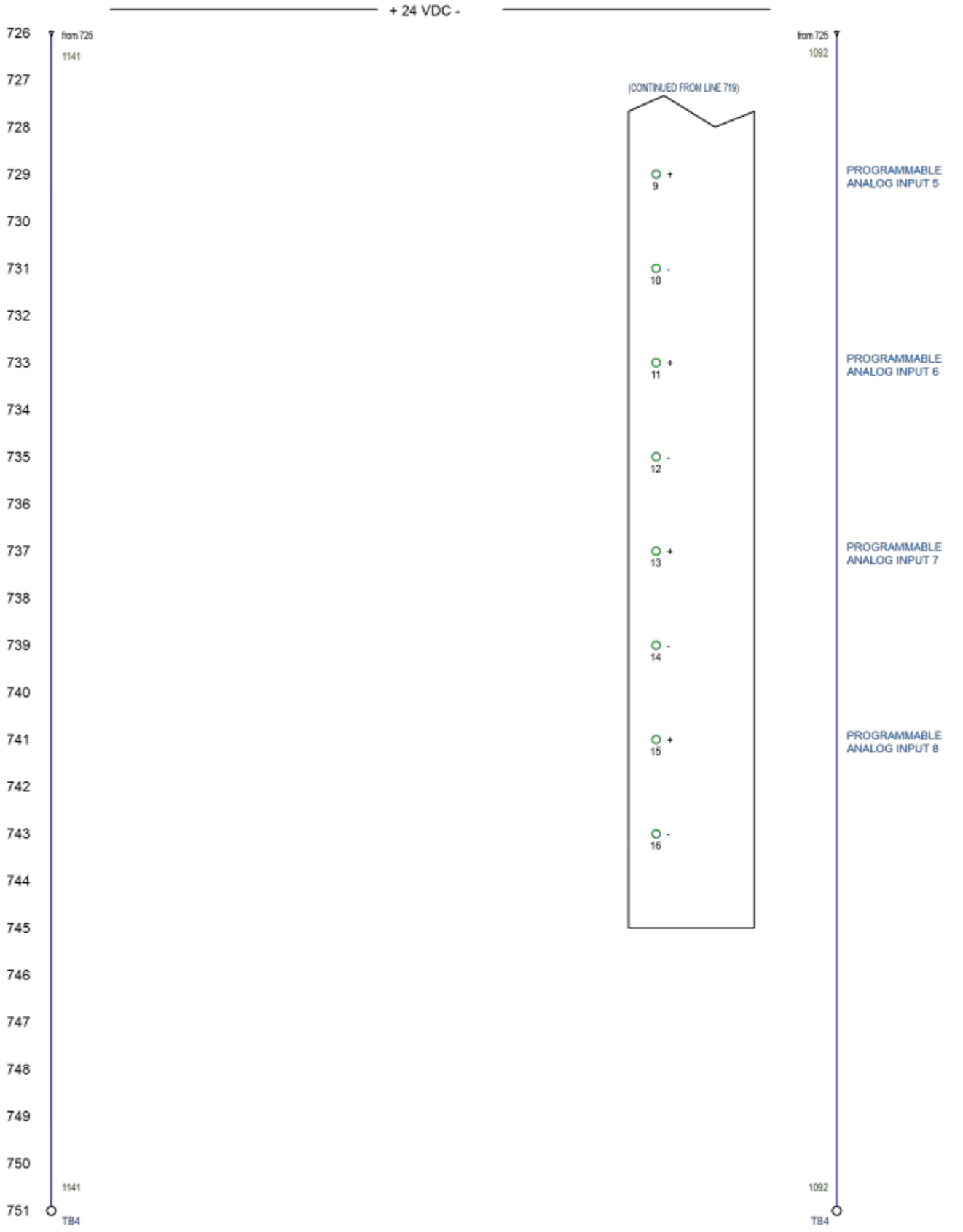
## DRAWING 6 (cont.)



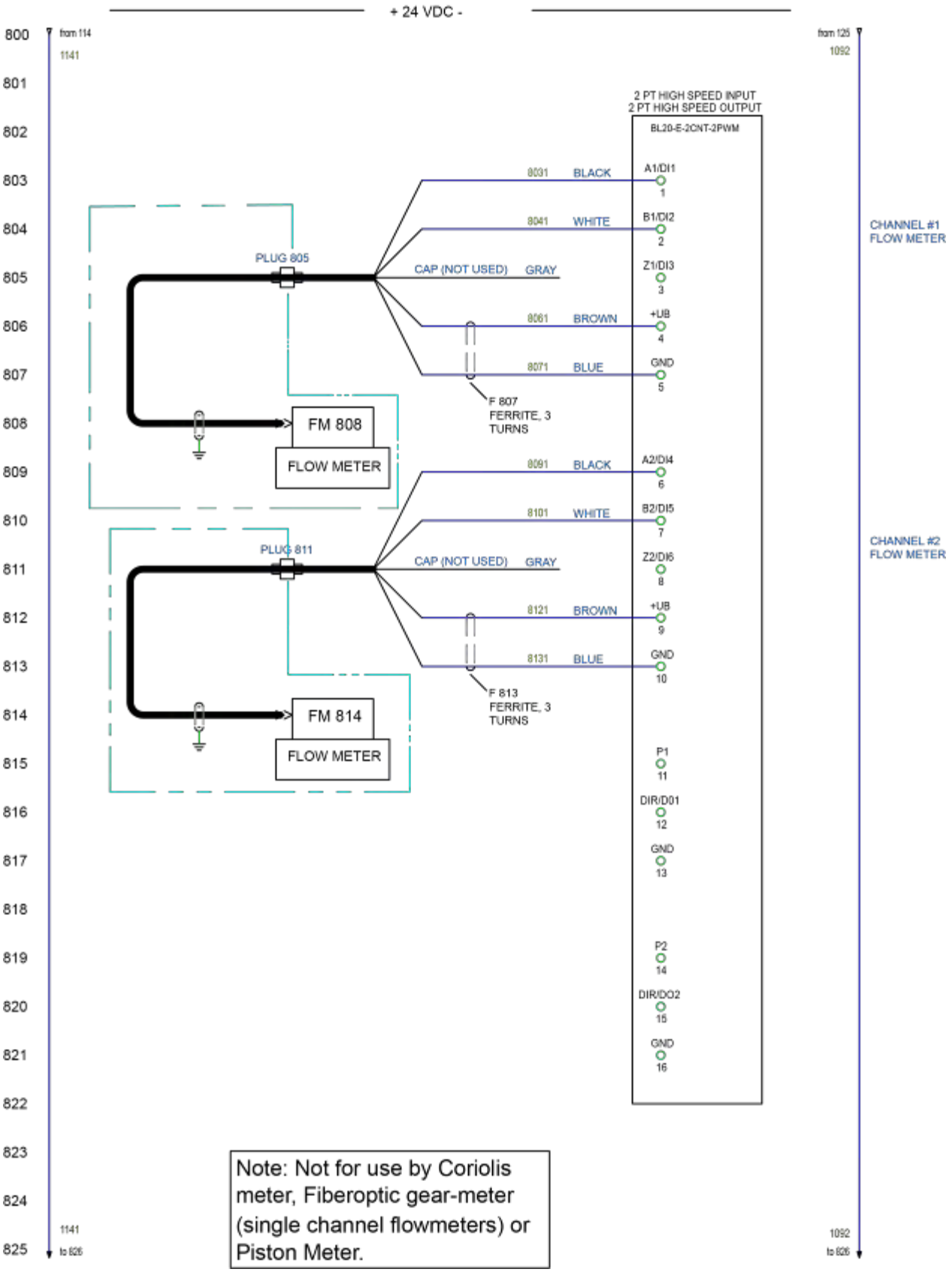
## DRAWING 7


+ 24 VDC -
700
701
702
703
704
705
706
707
708
709
710
711
712
713
714
715
716
717
718
719
720
721
722
723
724
725
from 114
1141
from 125
1092
SLOT 5
ANALOG INPUT
BL20-E-8AI-U/I-4PT/NI
703
SCM-310-4201-1
1
+
2
-
1092
3
+
4
-
5
+
6
-
7
+
8
-
In-Booth Control
Color Box 1
PROGRAMMABLE
ANALOG INPUT 2
PROGRAMMABLE
ANALOG INPUT 3
PROGRAMMABLE
ANALOG INPUT 4
(CONTINUED ON LINE 727)
1141
to 726
1092
to 726

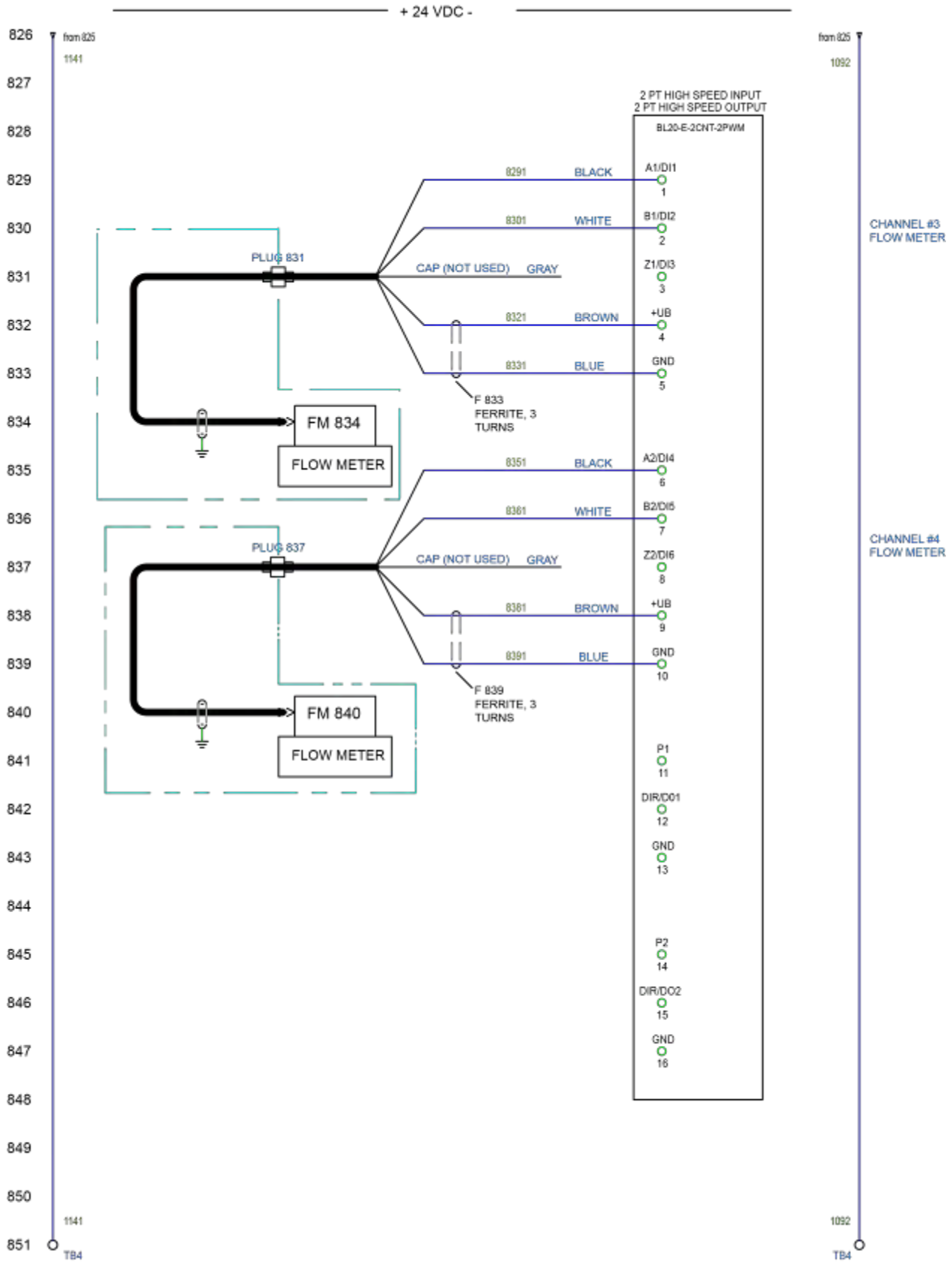
## DRAWING 7 (cont.)



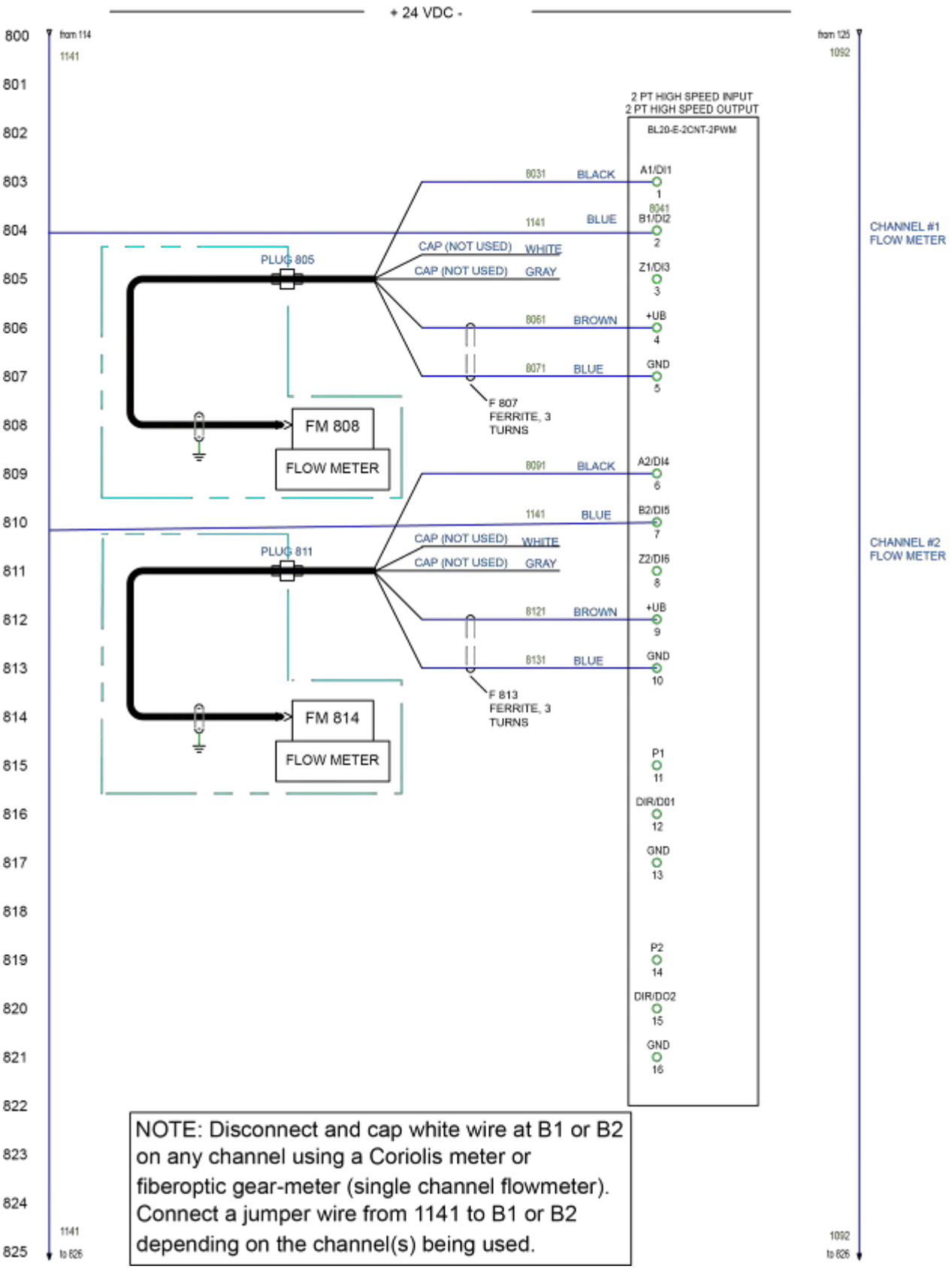
## DRAWING 8


+ 24 VDC -
from 114
1141
from 125
1092
2 PT HIGH SPEED INPUT
2 PT HIGH SPEED OUTPUT
BL20-E-2CNT-2PWM
PLUG 805
CAP (NOT USED) GRAY
8031 BLACK
8041 WHITE
8061 BROWN
8071 BLUE
F 807
FERRITE, 3
TURNS
FM 808
FLOW METER
PLUG 811
CAP (NOT USED) GRAY
8091 BLACK
8101 WHITE
8121 BROWN
8131 BLUE
F 813
FERRITE, 3
TURNS
FM 814
FLOW METER
A1/DI1 1
B1/DI2 2
Z1/DI3 3
+UB 4
GND 5
A2/DI4 6
B2/DI5 7
Z2/DI6 8
+UB 9
GND 10
P1 11
DIR/DO1 12
GND 13
P2 14
DIR/DO2 15
GND 16
CHANNEL #1
FLOW METER
CHANNEL #2
FLOW METER
1141
to 826
1092
to 826
Note: Not for use by Coriolis meter, Fiberoptic gear-meter (single channel flowmeters) or Piston Meter.

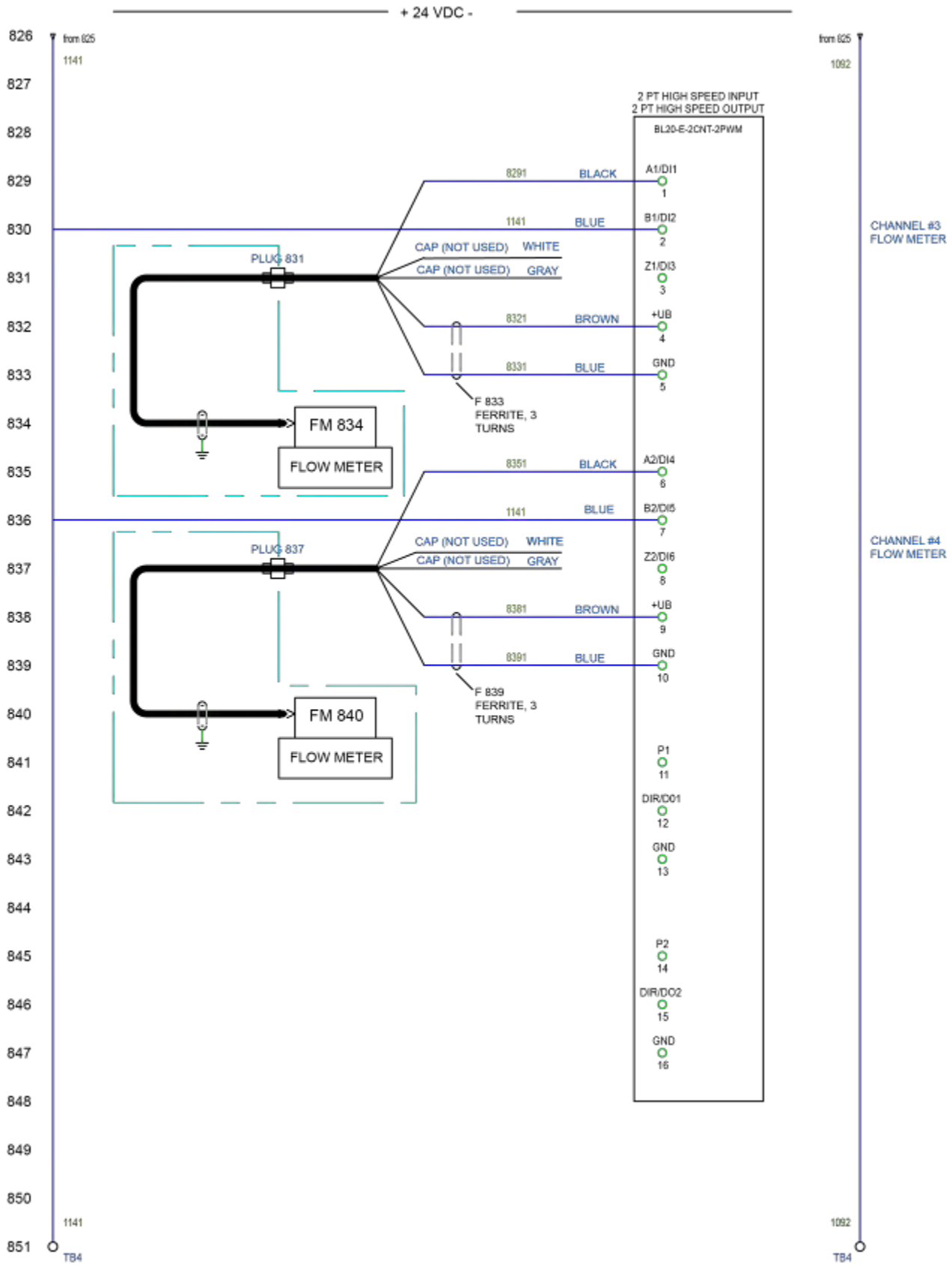
## DRAWING 8 (cont.)



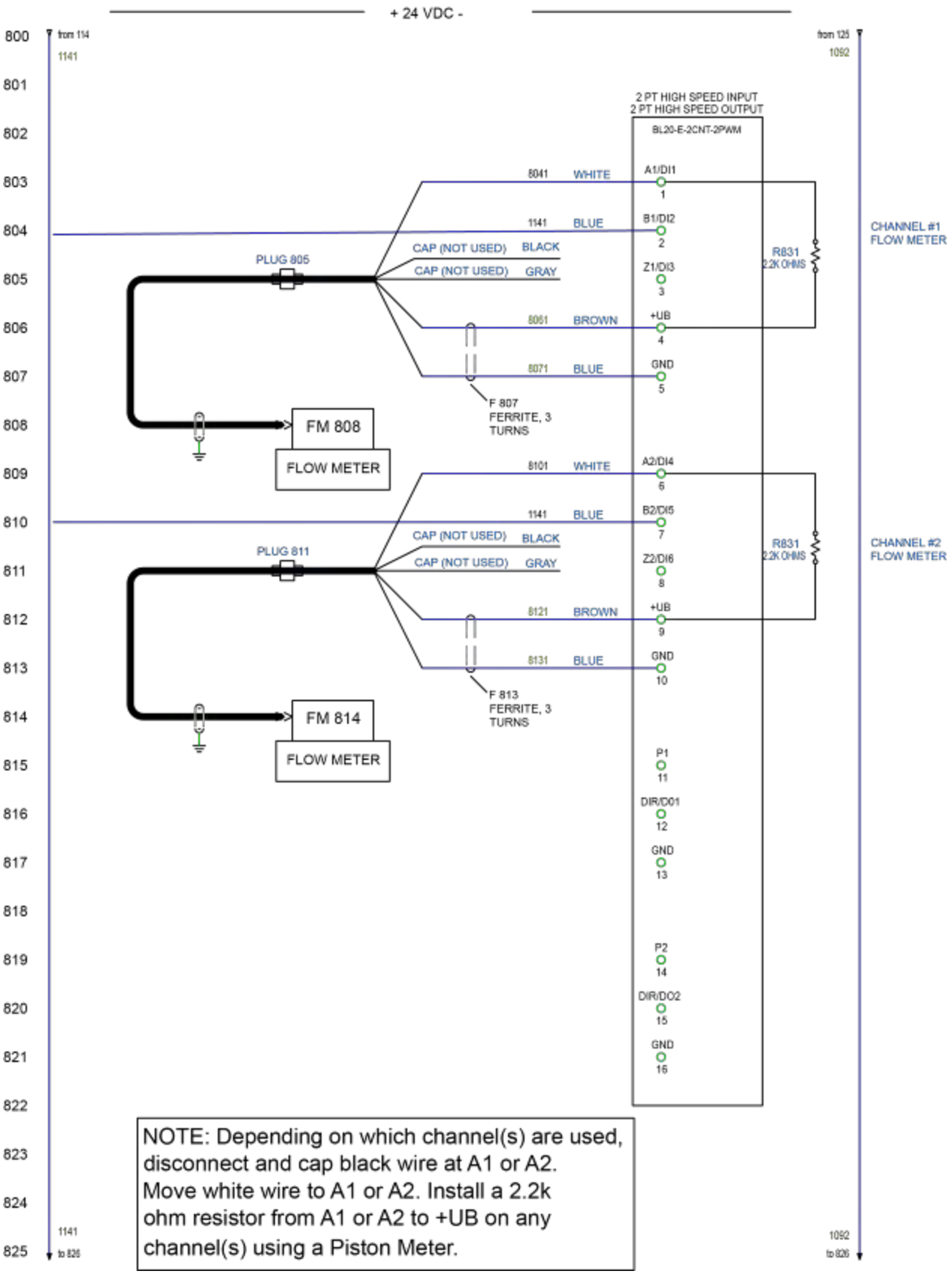
## DRAWING 8B


+ 24 VDC -
from 114
1141
from 125
1092
2 PT HIGH SPEED INPUT
2 PT HIGH SPEED OUTPUT
BL20-E-2CNT-2PWM
8031 BLACK
A1/DI1
1
8041
1141 BLUE
B1/DI2
2
CHANNEL #1
FLOW METER
CAP (NOT USED) WHITE
CAP (NOT USED) GRAY
PLUG 805
Z1/DI3
3
8061 BROWN
+UB
4
8071 BLUE
GND
5
F 807
FERRITE, 3
TURNS
FM 808
FLOW METER
8091 BLACK
A2/DI4
6
1141 BLUE
B2/DI5
7
CHANNEL #2
FLOW METER
CAP (NOT USED) WHITE
CAP (NOT USED) GRAY
PLUG 811
Z2/DI6
8
8121 BROWN
+UB
9
8131 BLUE
GND
10
F 813
FERRITE, 3
TURNS
FM 814
FLOW METER
P1
11
DIR/DO1
12
GND
13
P2
14
DIR/DO2
15
GND
16
1141
to 826
1092
to 826
NOTE: Disconnect and cap white wire at B1 or B2 on any channel using a Coriolis meter or fiberoptic gear-meter (single channel flowmeter). Connect a jumper wire from 1141 to B1 or B2 depending on the channel(s) being used.

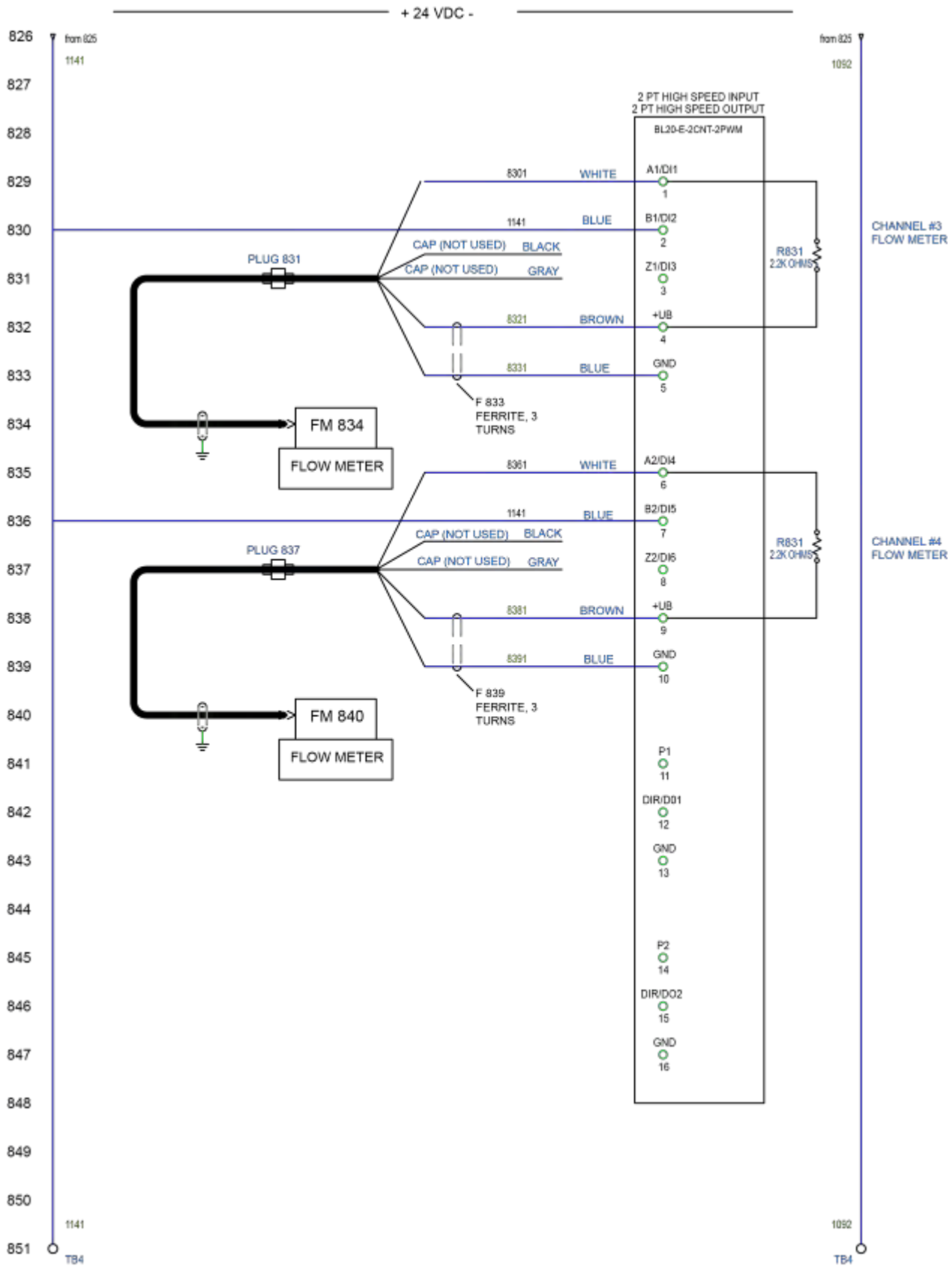
## DRAWING 8B (cont.)



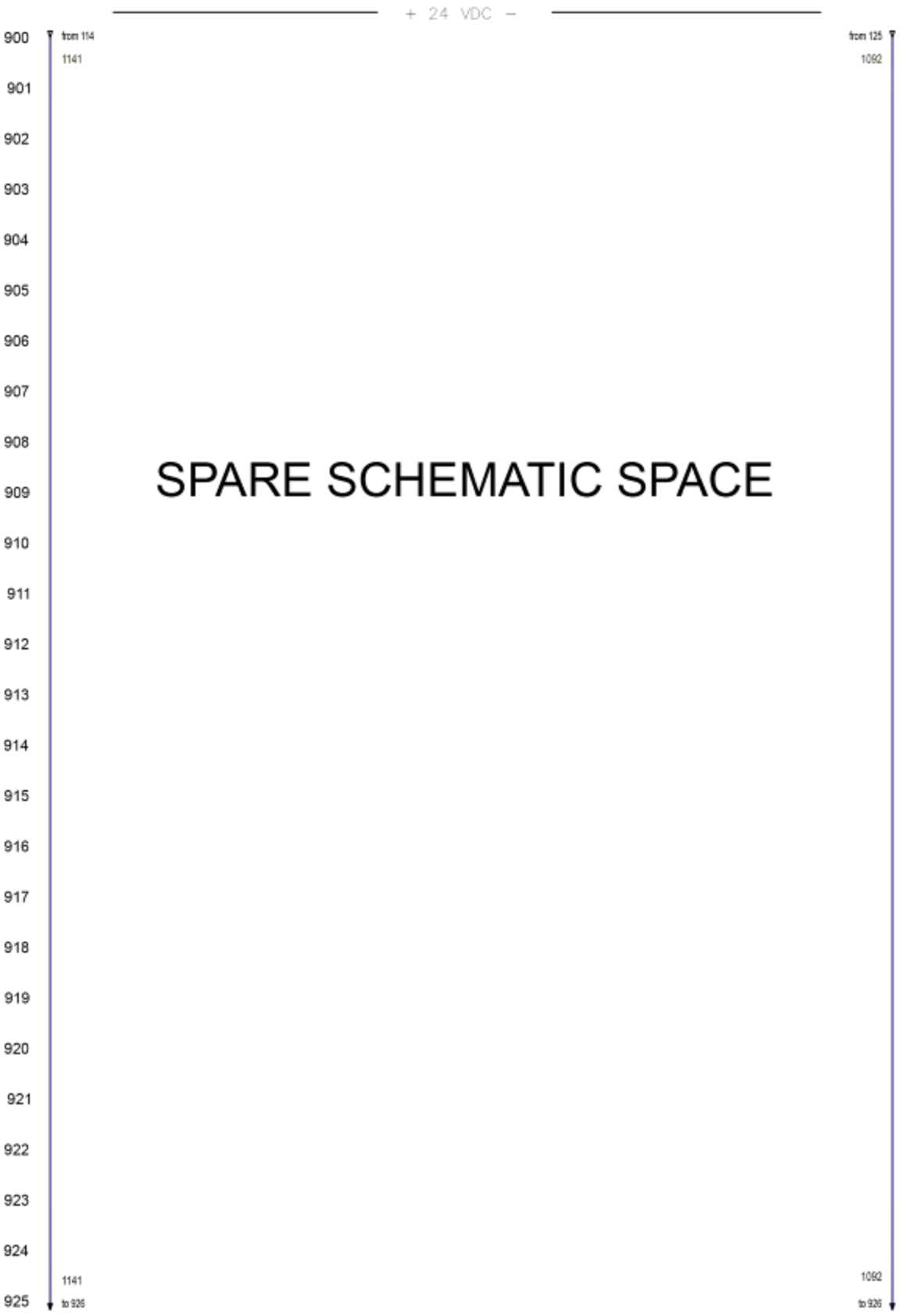
## DRAWING 8C


+ 24 VDC -
from 114
1141
from 125
1092
2 PT HIGH SPEED INPUT
2 PT HIGH SPEED OUTPUT
BL20-E-2CNT-2PWM
8041 WHITE
A1/DI1
1
1141 BLUE
B1/DI2
2
CAP (NOT USED) BLACK
CAP (NOT USED) GRAY
Z1/DI3
3
R831
2.2K OHMS
CHANNEL #1
FLOW METER
PLUG 805
8051 BROWN
+UB
4
8071 BLUE
GND
5
F 807
FERRITE, 3
TURNS
FM 808
FLOW METER
8101 WHITE
A2/DI4
6
1141 BLUE
B2/DI5
7
CAP (NOT USED) BLACK
CAP (NOT USED) GRAY
Z2/DI6
8
R831
2.2K OHMS
CHANNEL #2
FLOW METER
PLUG 811
8121 BROWN
+UB
9
8131 BLUE
GND
10
F 813
FERRITE, 3
TURNS
FM 814
FLOW METER
P1
11
DIR/DO1
12
GND
13
P2
14
DIR/DO2
15
GND
16
1141
to 826
1092
to 826
NOTE: Depending on which channel(s) are used, disconnect and cap black wire at A1 or A2. Move white wire to A1 or A2. Install a 2.2k ohm resistor from A1 or A2 to +UB on any channel(s) using a Piston Meter.

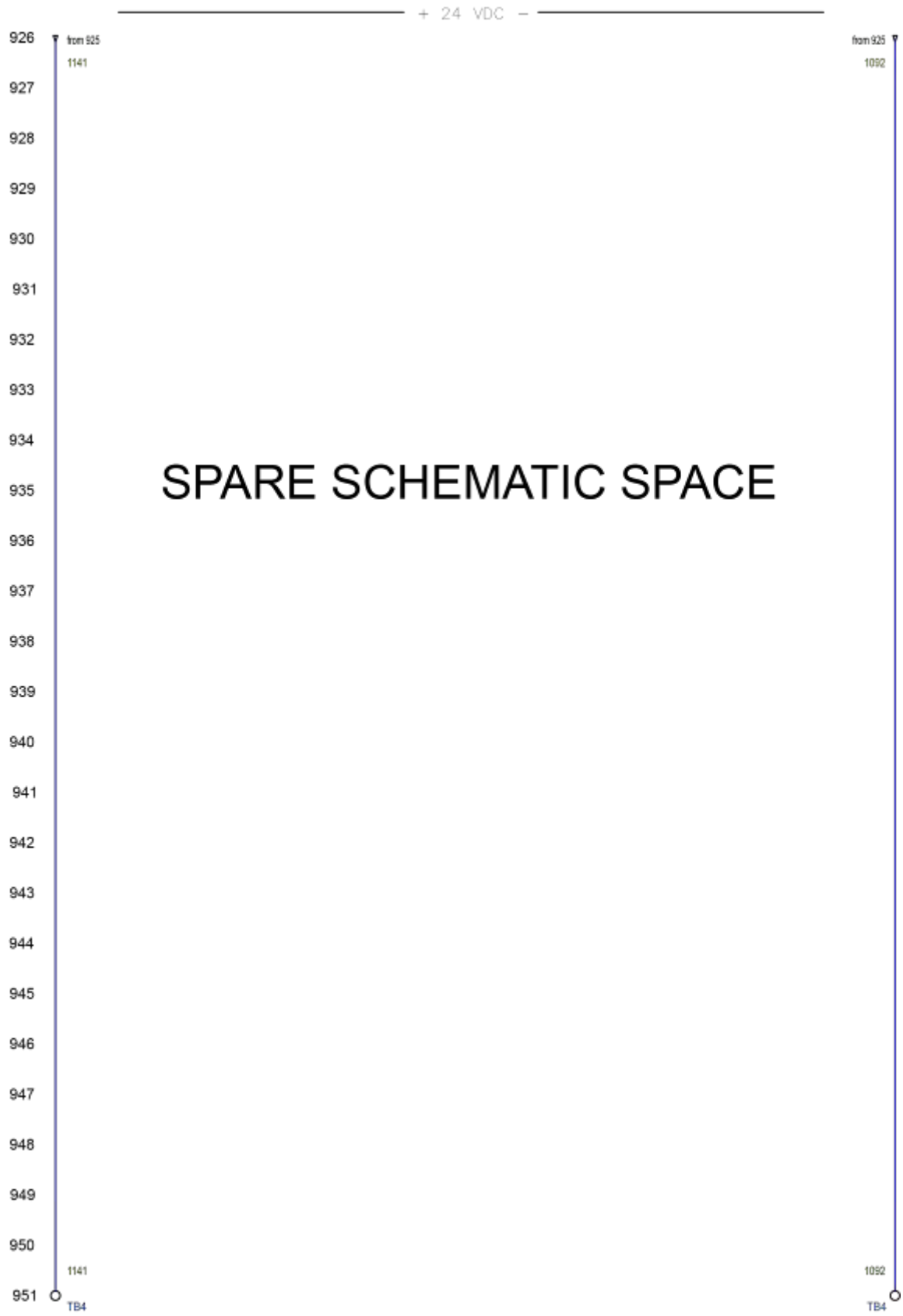
## DRAWING 8C (cont.)



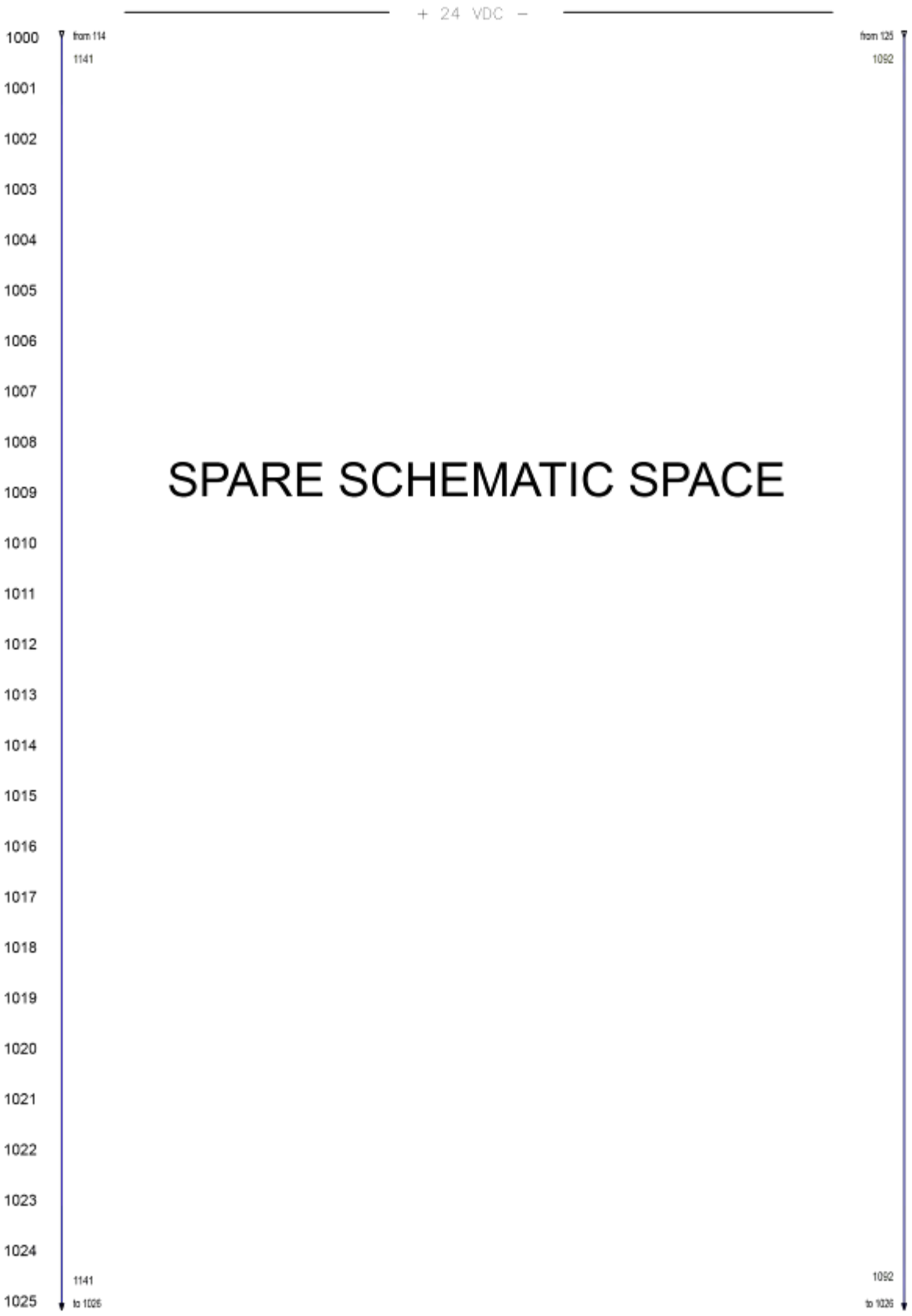
## DRAWING 9


+ 24 VDC –
900
901
902
903
904
905
906
907
908
909
910
911
912
913
914
915
916
917
918
919
920
921
922
923
924
925
from 114
1141
1141
to 926
from 125
1092
1092
to 926
SPARE SCHEMATIC SPACE

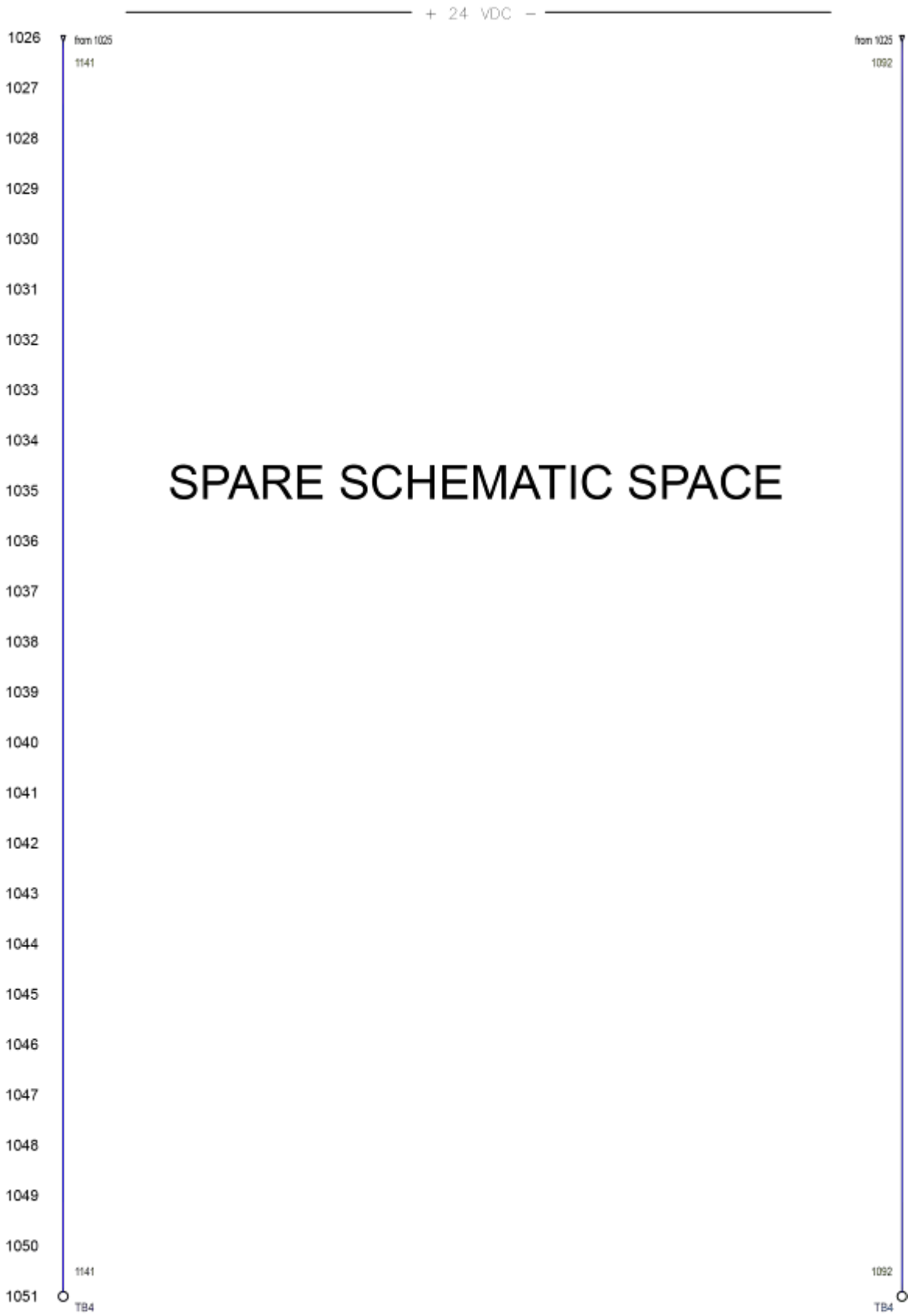
## DRAWING 9 (cont.)



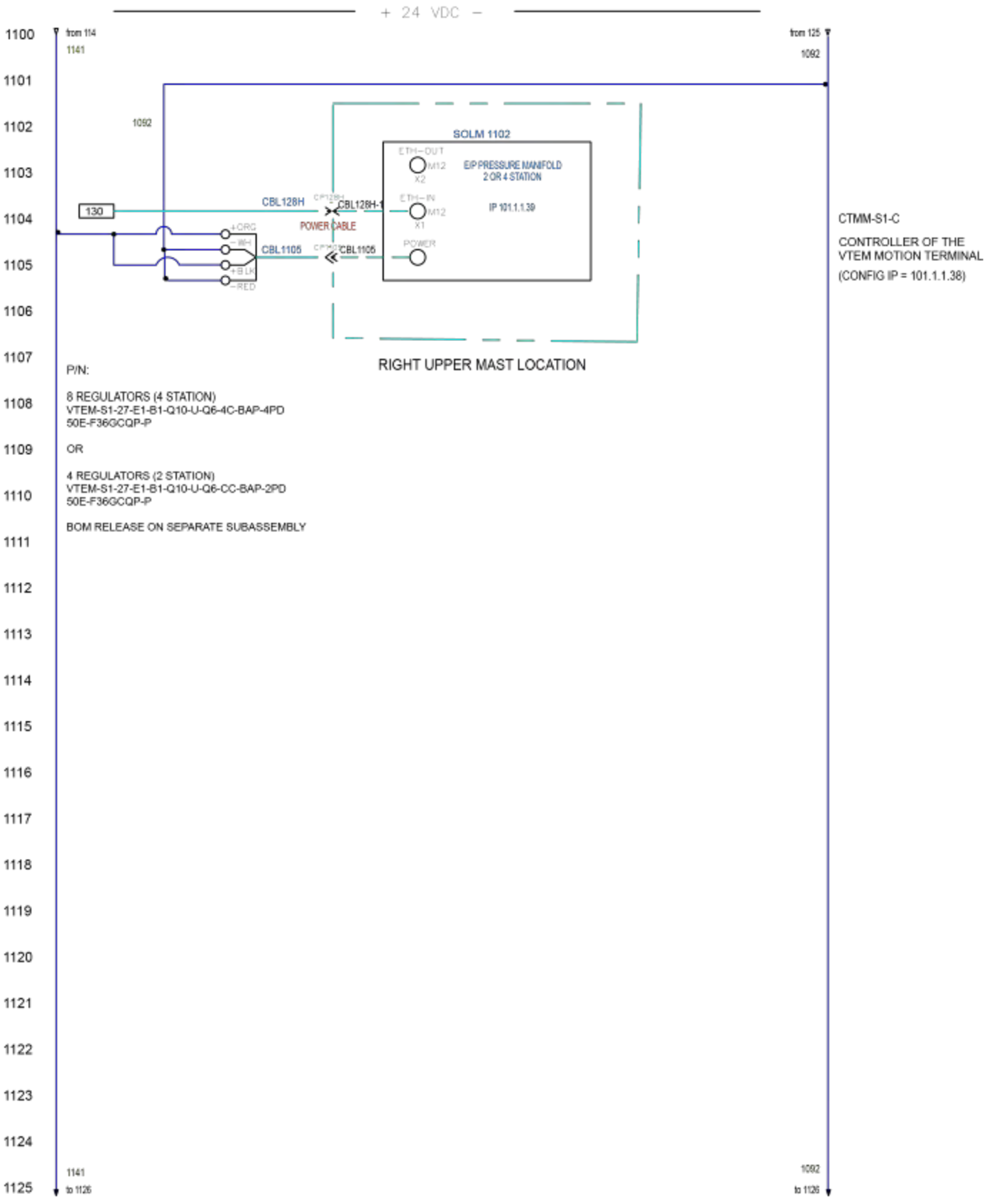
## DRAWING 10


+ 24 VDC –
1000
1001
1002
1003
1004
1005
1006
1007
1008
1009
1010
1011
1012
1013
1014
1015
1016
1017
1018
1019
1020
1021
1022
1023
1024
1025
from 114
1141
1141
to 1026
from 125
1092
1092
to 1026
SPARE SCHEMATIC SPACE

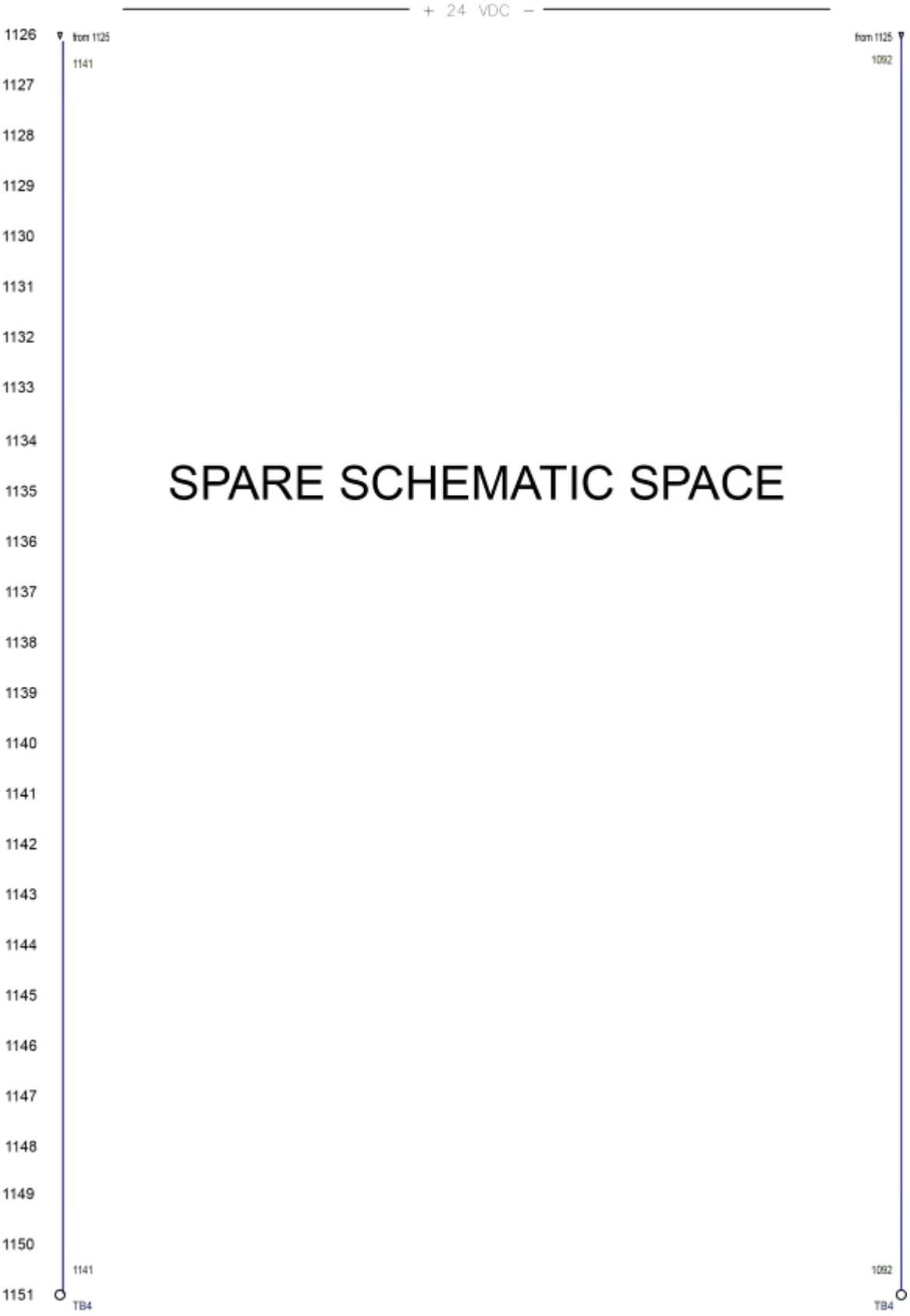
## DRAWING 10 (cont.)



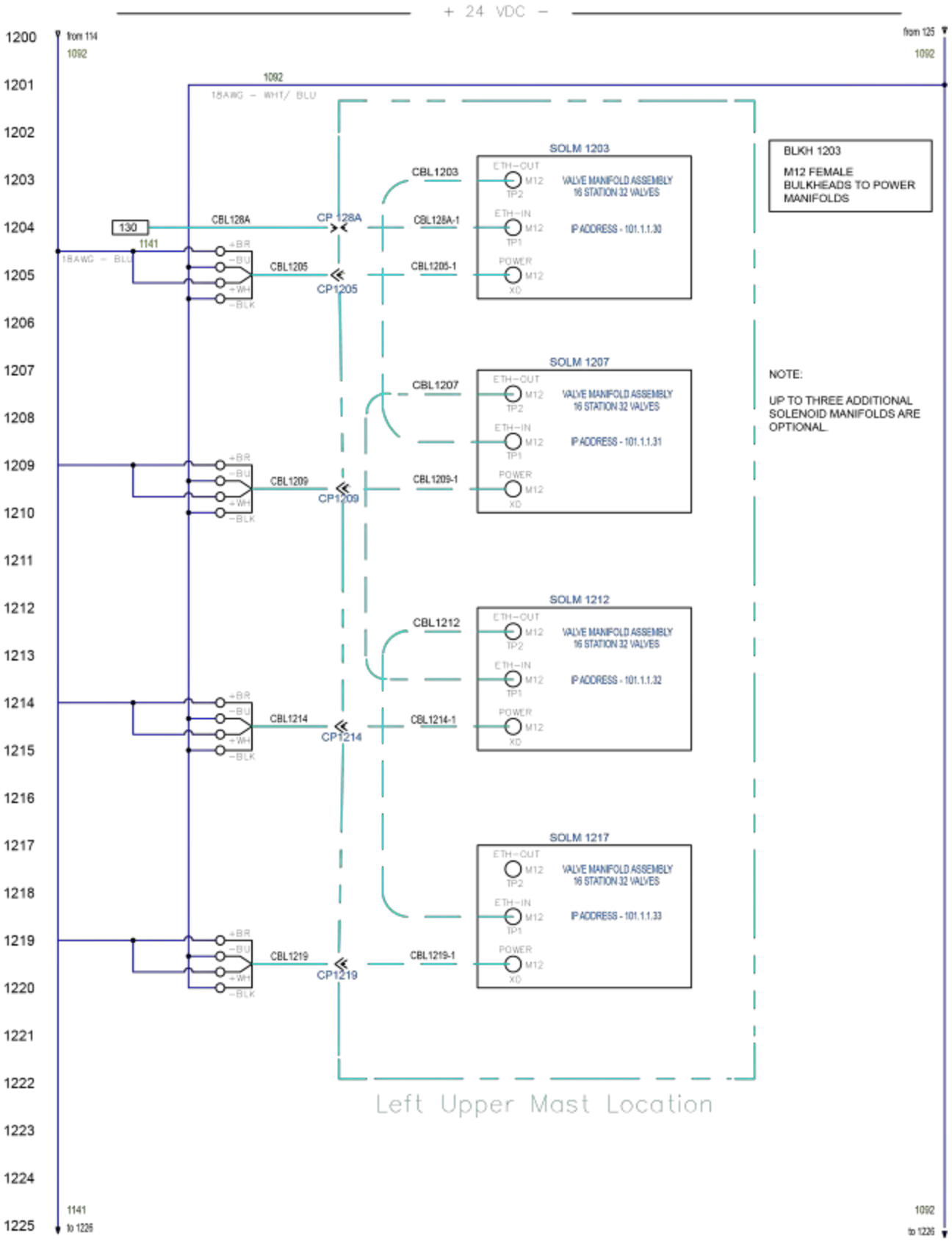
## DRAWING 11


+ 24 VDC −
1100
1101
1102
1103
1104
1105
1106
1107
1108
1109
1110
1111
1112
1113
1114
1115
1116
1117
1118
1119
1120
1121
1122
1123
1124
1125
from 114
1141
from 125
1092
1092
SOLM 1102
ETH−OUT
M12
X2
EIP PRESSURE MANIFOLD
2 OR 4 STATION
ETH−IN
M12
X1
IP 101.1.1.39
POWER
130
CBL128H
CBL128H-1
POWER CABLE
+GRG
−WHT
+BLK
−RED
CBL1105
CBL1105
CTMM-S1-C
CONTROLLER OF THE
VTEM MOTION TERMINAL
(CONFIG IP = 101.1.1.38)
RIGHT UPPER MAST LOCATION
P/N:
8 REGULATORS (4 STATION)
VTEM-S1-27-E1-B1-Q10-U-Q6-4C-BAP-4PD
50E-F36GCQP-P
OR
4 REGULATORS (2 STATION)
VTEM-S1-27-E1-B1-Q10-U-Q6-CC-BAP-2PD
50E-F36GCQP-P
BOM RELEASE ON SEPARATE SUBASSEMBLY
1141
to 1126
1092
to 1126

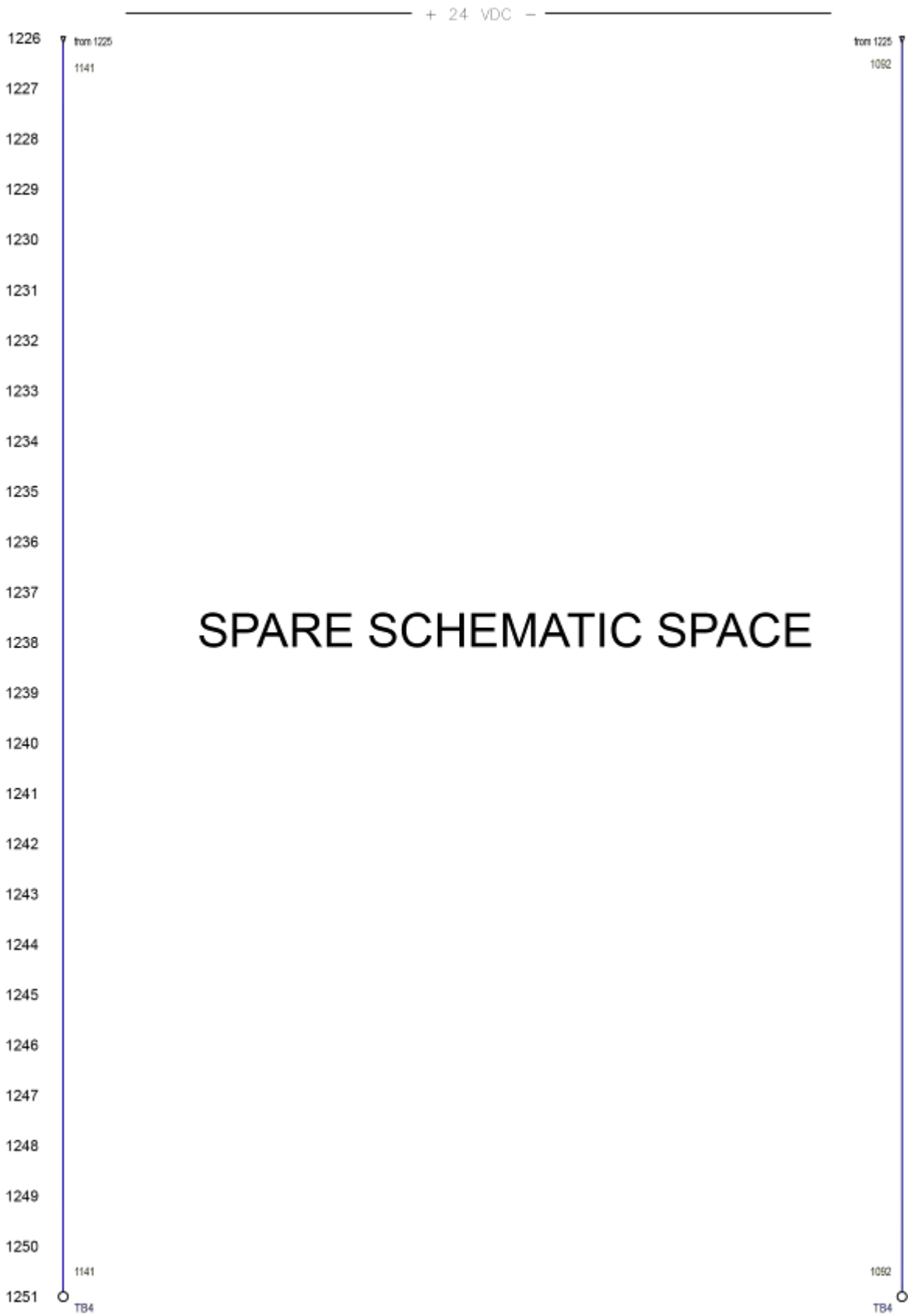
## DRAWING 11 (cont.)



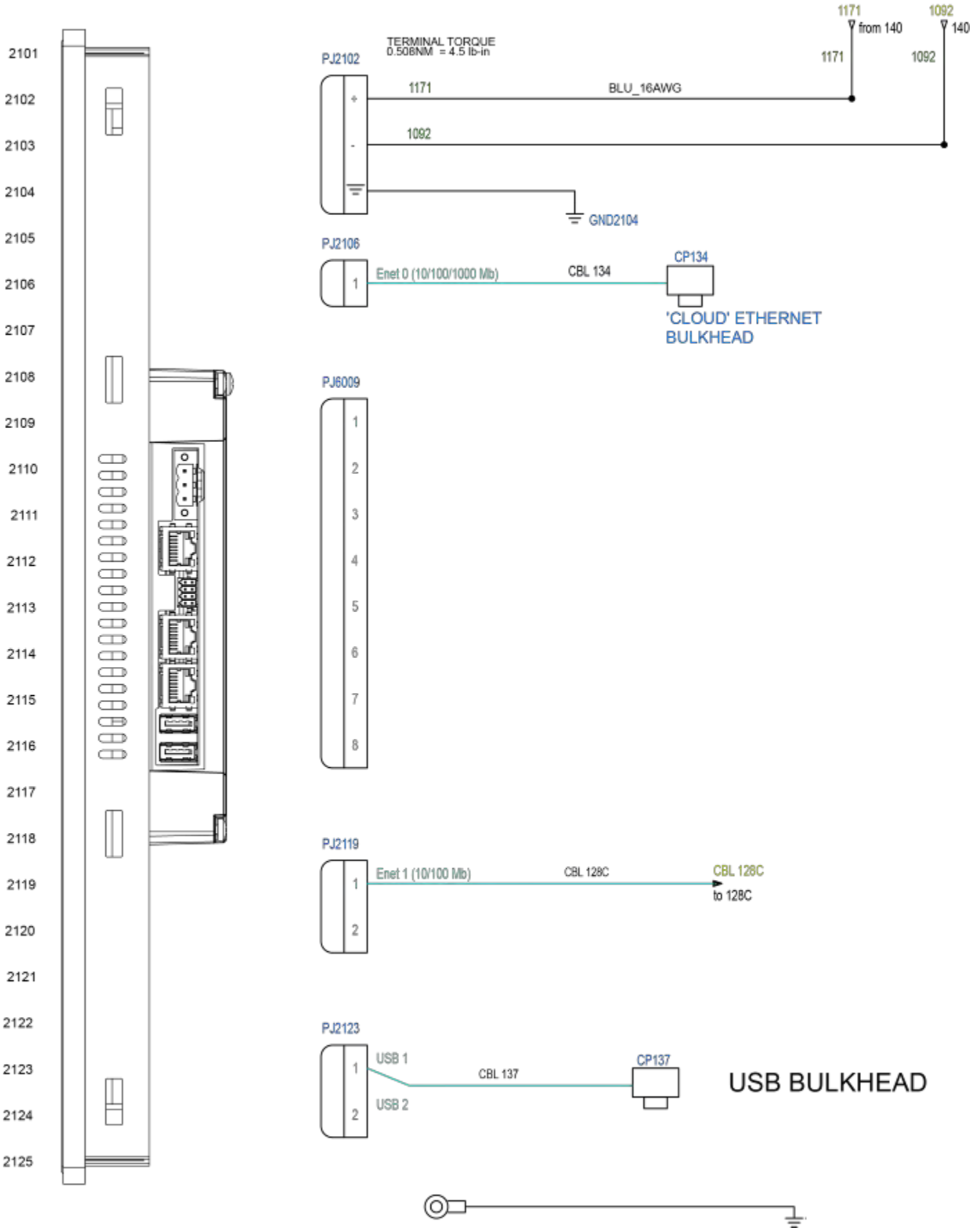
## DRAWING 12


+ 24 VDC −
from 114
1092
from 125
1092
1092
18AWG - WHT/ BLU
SOLM 1203
SOLM 1207
SOLM 1212
SOLM 1217
VALVE MANIFOLD ASSEMBLY
16 STATION 32 VALVES
IP ADDRESS - 101.1.1.30
IP ADDRESS - 101.1.1.31
IP ADDRESS - 101.1.1.32
IP ADDRESS - 101.1.1.33
ETH-OUT
ETH-IN
POWER
M12
TP1
TP2
XD
CBL1203
CBL1205
CBL1207
CBL1209
CBL1212
CBL1214
CBL1217
CBL1219
CBL128A
CBL128A-1
CBL1205-1
CBL1209-1
CBL1214-1
CBL1219-1
CP 128A
CP1205
CP1209
CP1214
CP1219
130
1141
18AWG - BLU
+BR
-BU
+WH
-BLK
BLKH 1203
M12 FEMALE
BULKHEADS TO POWER
MANIFOLDS
NOTE:
UP TO THREE ADDITIONAL
SOLENOID MANIFOLDS ARE
OPTIONAL.
Left Upper Mast Location
1141
to 1226
1092
to 1226

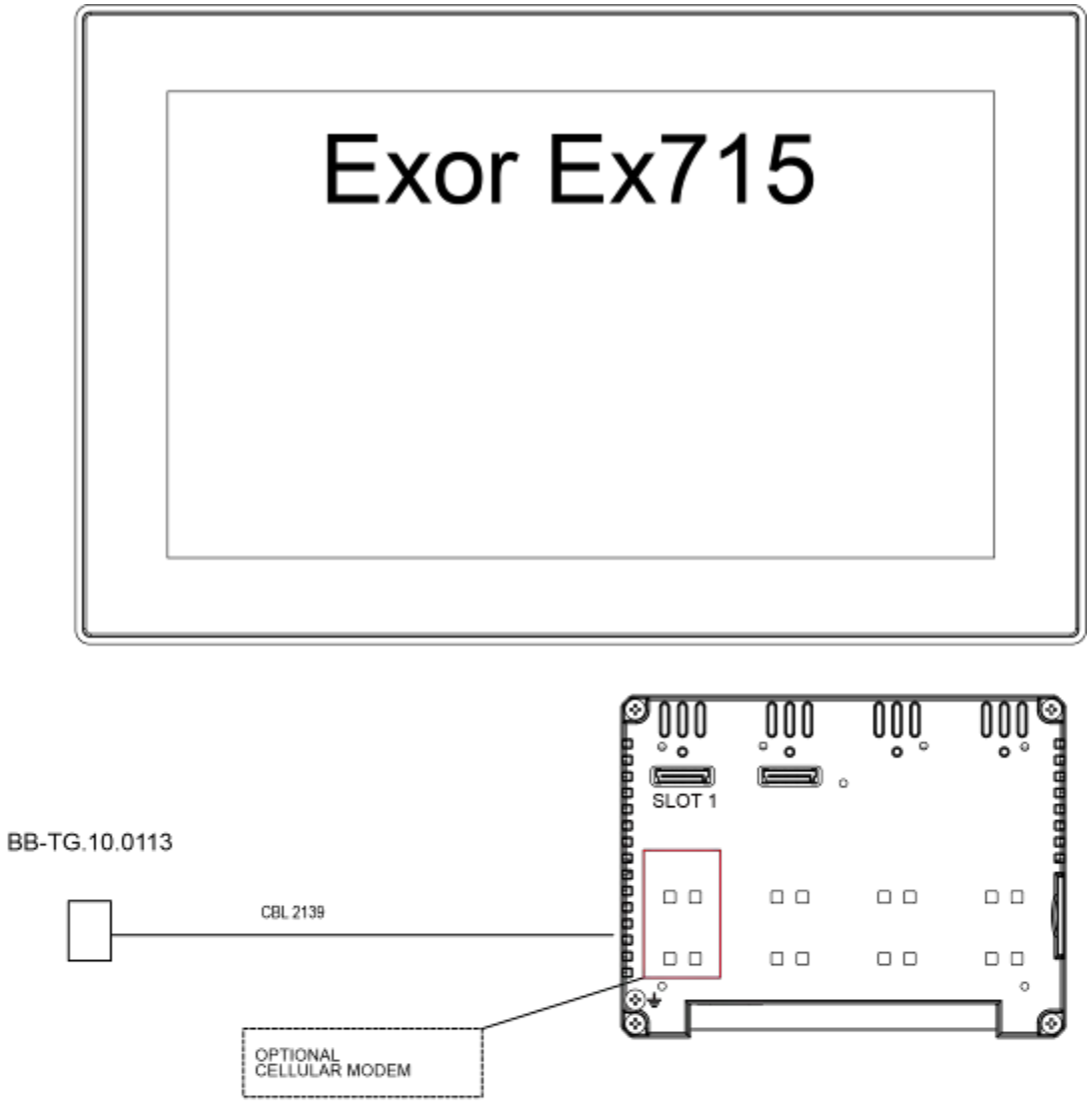
## DRAWING 12 (cont.)



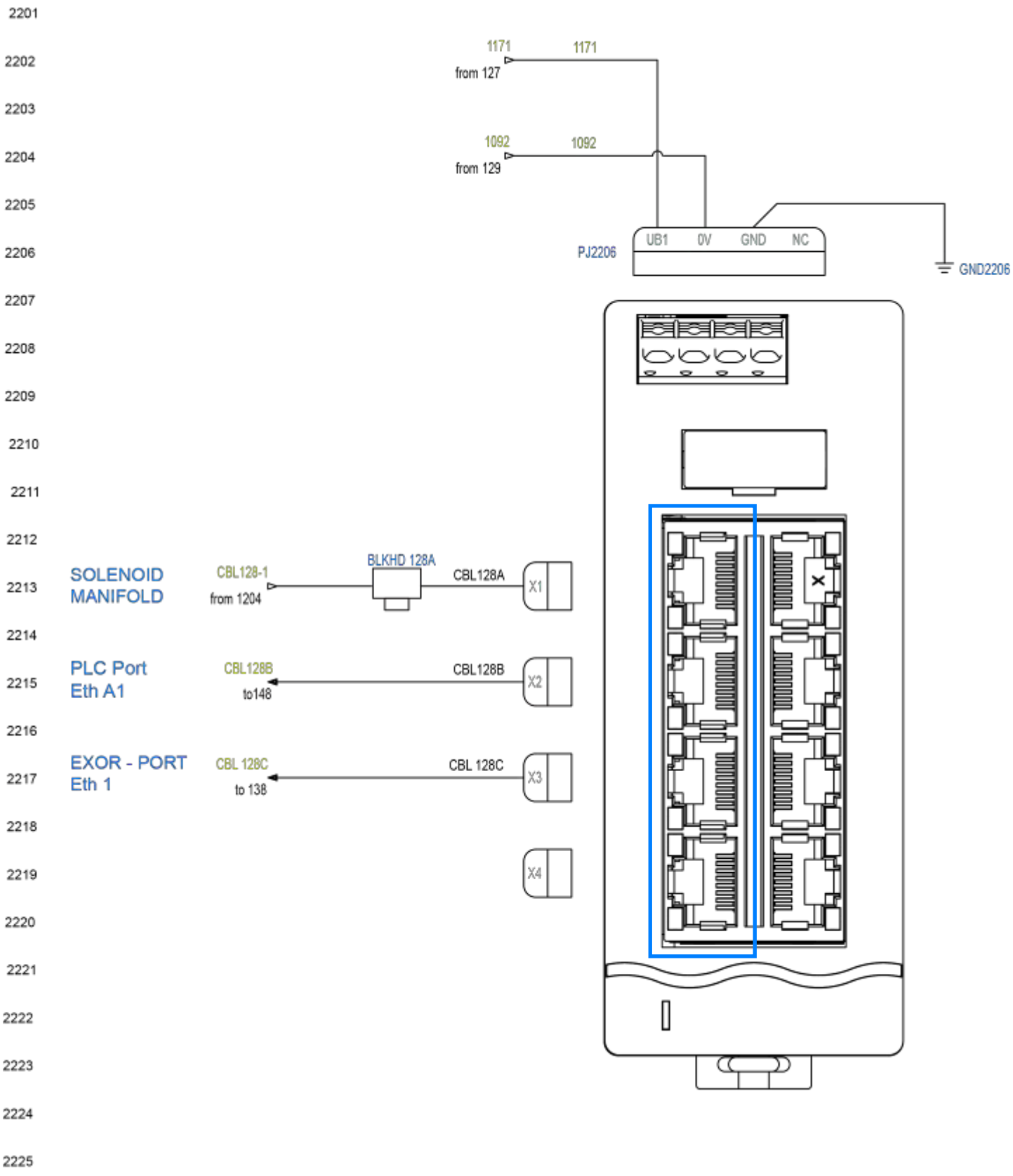
## DRAWING 21


2101
2102
2103
2104
2105
2106
2107
2108
2109
2110
2111
2112
2113
2114
2115
2116
2117
2118
2119
2120
2121
2122
2123
2124
2125
TERMINAL TORQUE
0.508NM = 4.5 lb-in
PJ2102
+
-
1171
BLU_16AWG
1092
1171
from 140
1092
140
GND2104
PJ2106
1
Enet 0 (10/100/1000 Mb)
CBL 134
CP134
'CLOUD' ETHERNET
BULKHEAD
PJ6009
1
2
3
4
5
6
7
8
PJ2119
1
2
Enet 1 (10/100 Mb)
CBL 128C
CBL 128C
to 128C
PJ2123
1
2
USB 1
USB 2
CBL 137
CP137
USB BULKHEAD

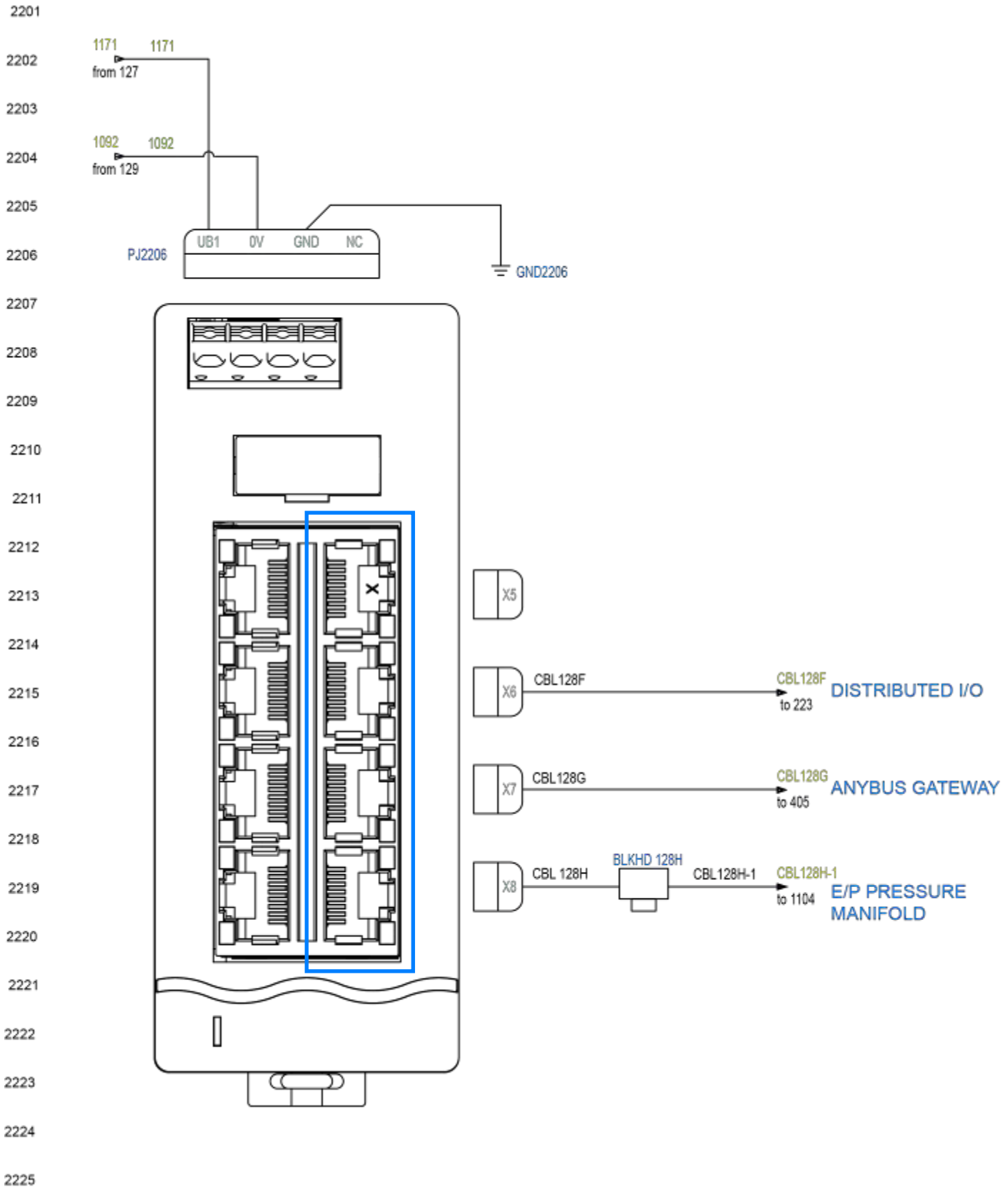
## DRAWING 21 (cont.)



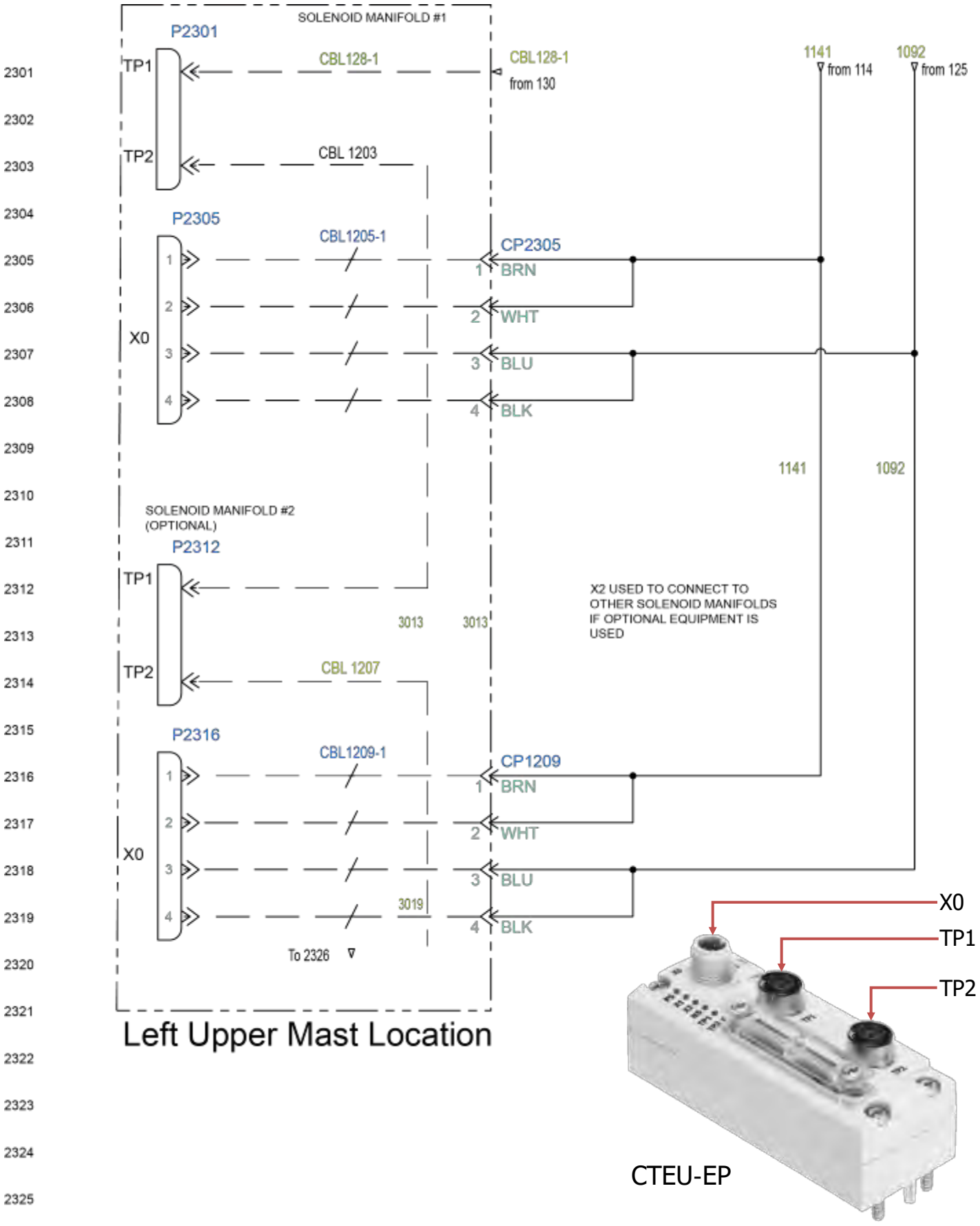
## DRAWING 22


1171
from 127
1171
1092
from 129
1092
PJ2206
UB1
0V
GND
NC
GND2206
SOLENOID MANIFOLD
CBL128-1
from 1204
BLKHD 128A
CBL128A
X1
PLC Port Eth A1
CBL128B
to148
CBL128B
X2
EXOR - PORT Eth 1
CBL 128C
to 138
CBL 128C
X3
X4

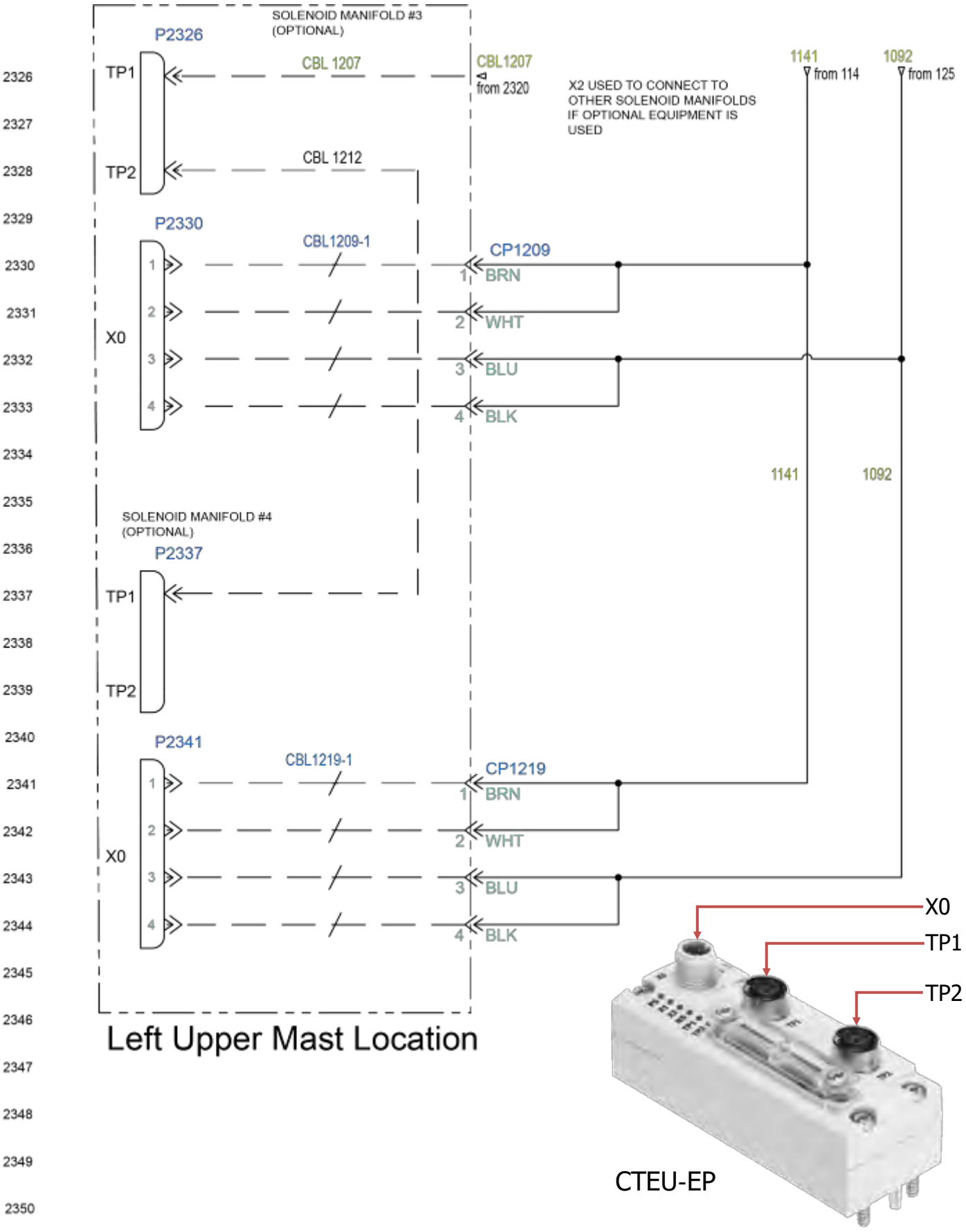
## DRAWING 22 (cont.)



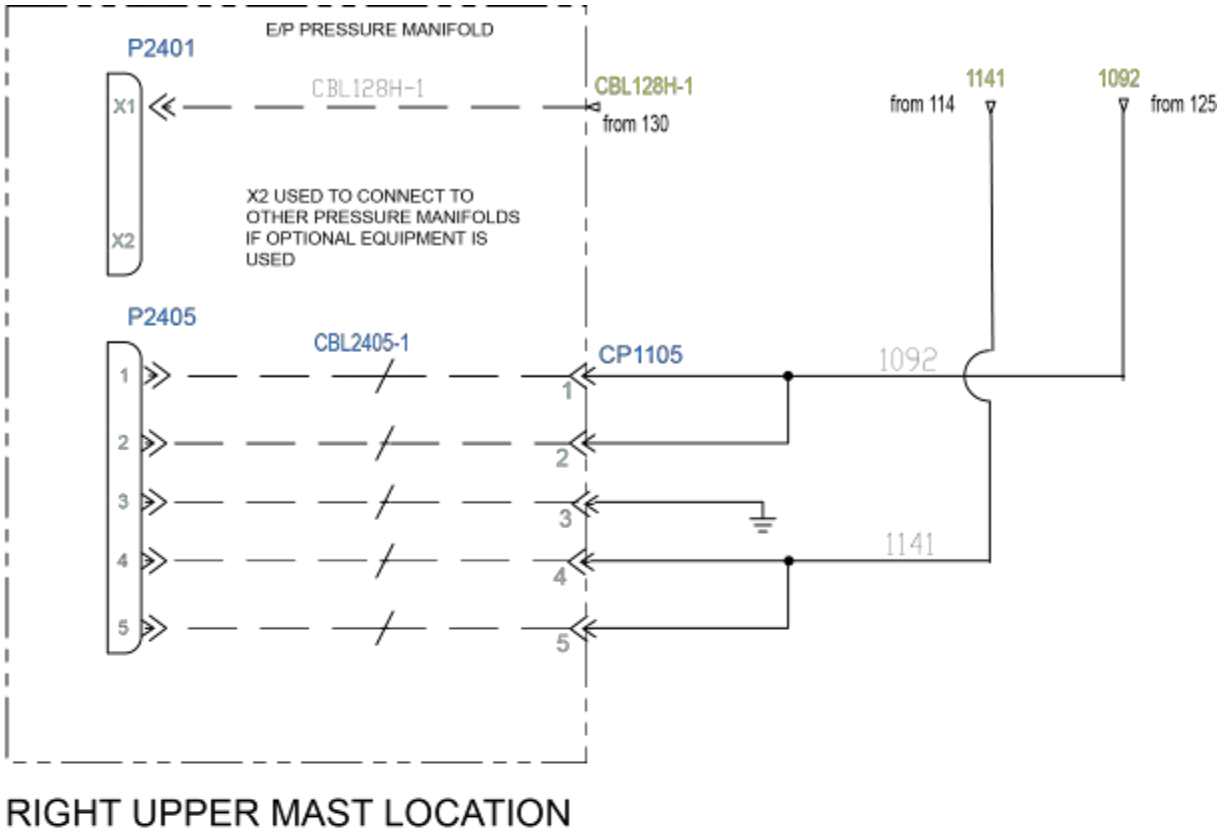
## DRAWING 23


SOLENOID MANIFOLD #1
P2301
TP1
TP2
CBL128-1
CBL128-1
from 130
CBL 1203
1141
from 114
1092
from 125
P2305
CBL1205-1
CP2305
X0
1 BRN
2 WHT
3 BLU
4 BLK
1141
1092
SOLENOID MANIFOLD #2
(OPTIONAL)
P2312
TP1
TP2
3013
3013
CBL 1207
X2 USED TO CONNECT TO
OTHER SOLENOID MANIFOLDS
IF OPTIONAL EQUIPMENT IS
USED
P2316
CBL1209-1
CP1209
X0
1 BRN
2 WHT
3 BLU
3019
4 BLK
To 2326
Left Upper Mast Location
X0
TP1
TP2
CTEU-EP

## DRAWING 23 (cont.)

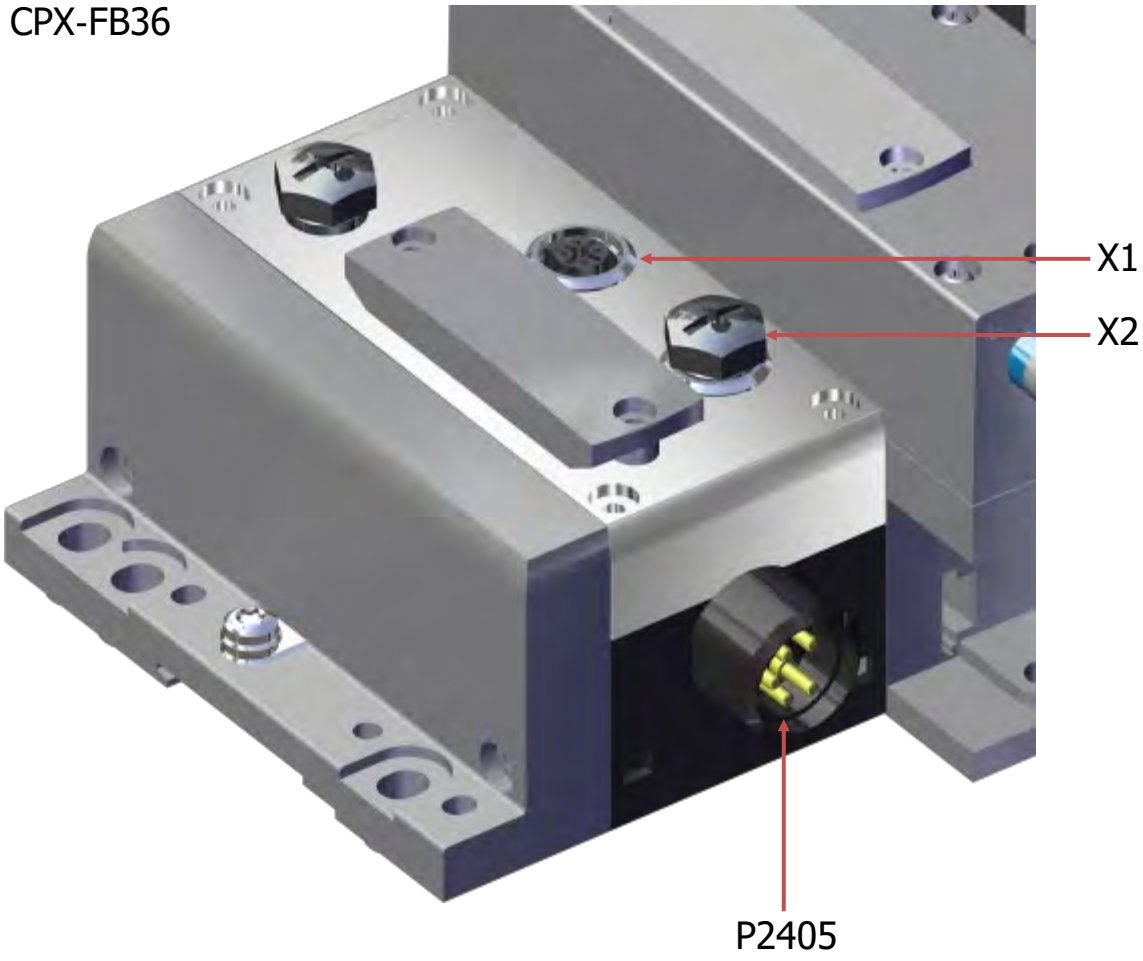


## DRAWING 24

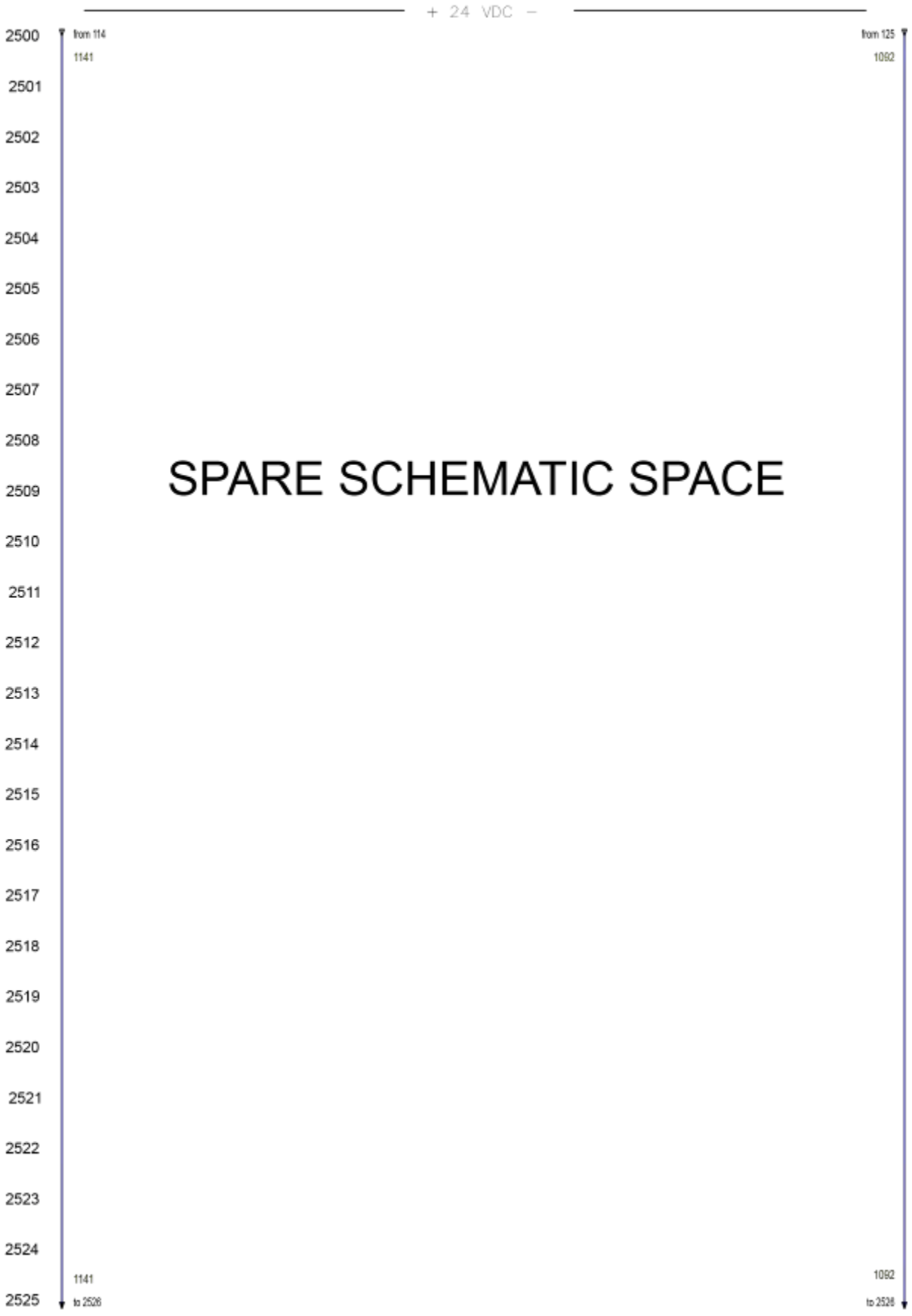



RIGHT UPPER MAST LOCATION

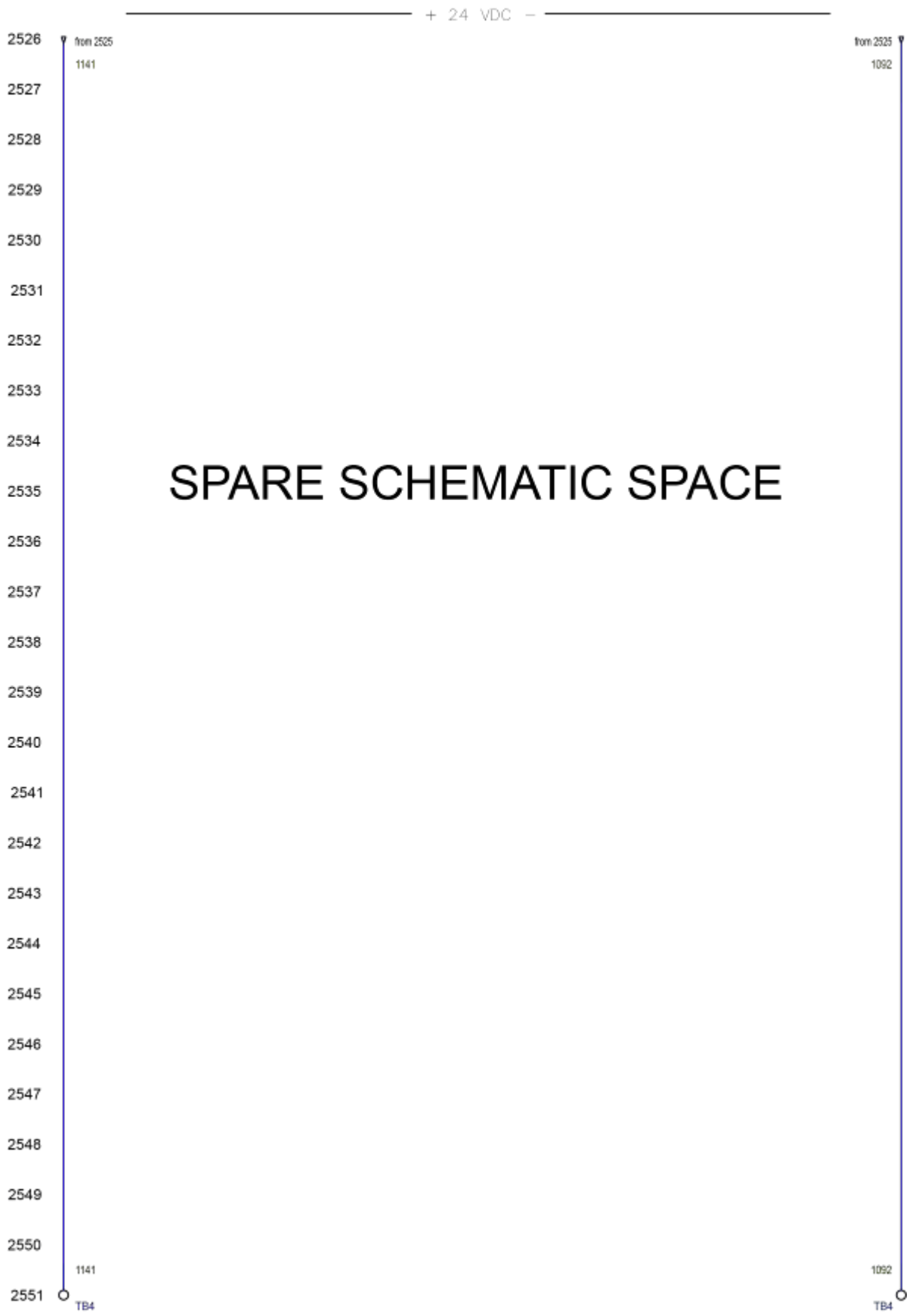
## DRAWING 24 (cont.)



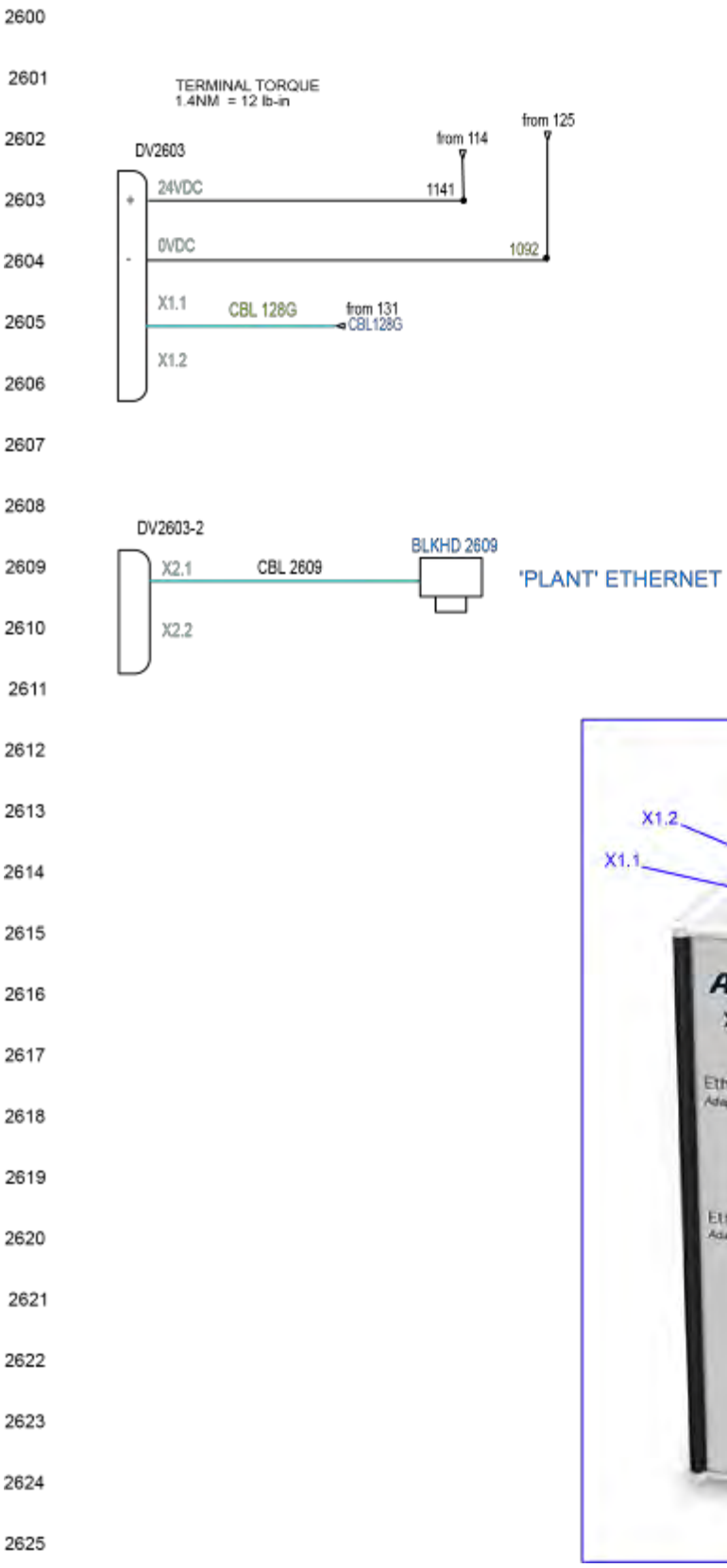
## DRAWING 25


+ 24 VDC –
2500
2501
2502
2503
2504
2505
2506
2507
2508
2509
2510
2511
2512
2513
2514
2515
2516
2517
2518
2519
2520
2521
2522
2523
2524
2525
from 114
1141
from 125
1092
SPARE SCHEMATIC SPACE
1141
to 2526
1092
to 2526

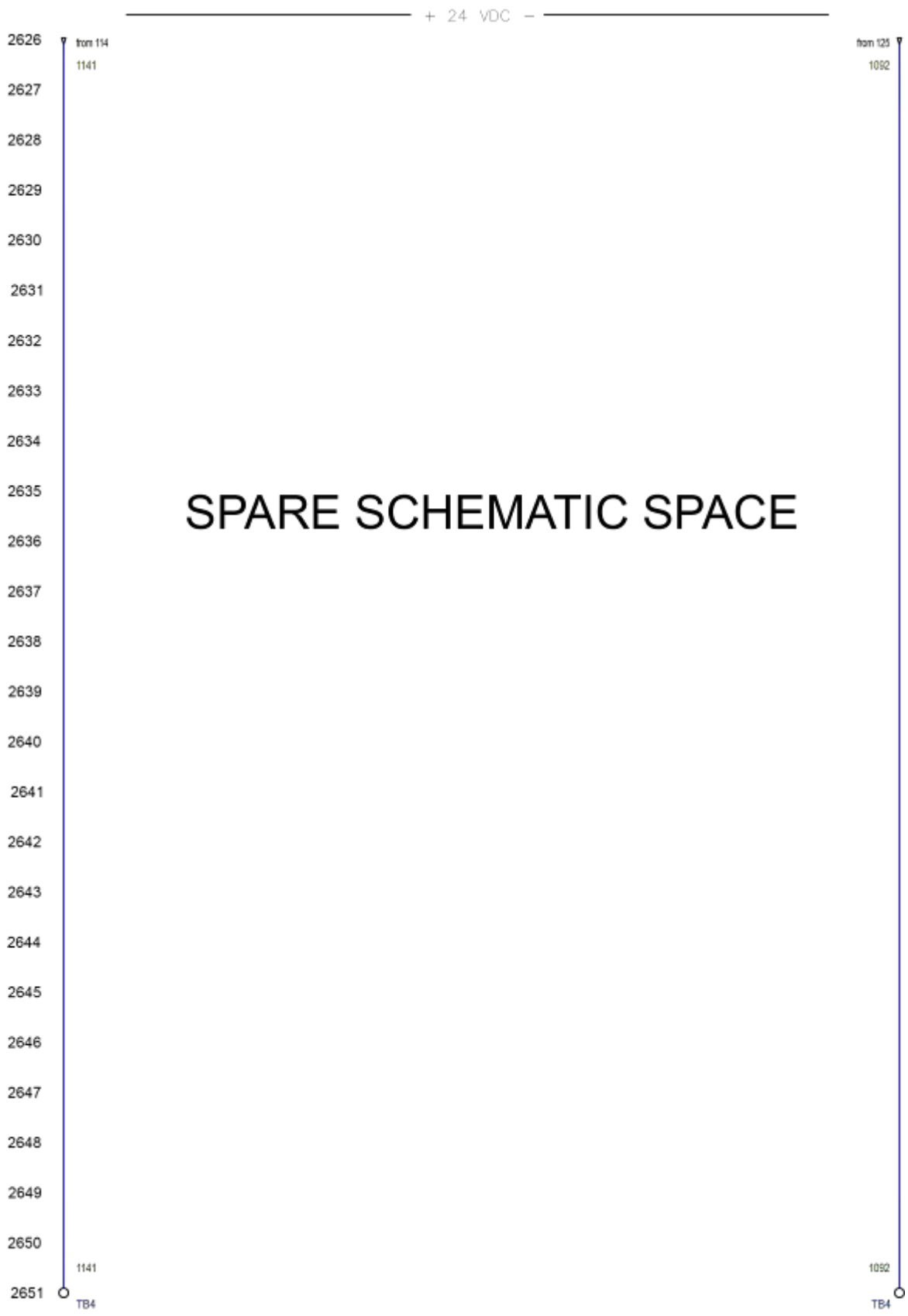
## DRAWING 25 (cont.)



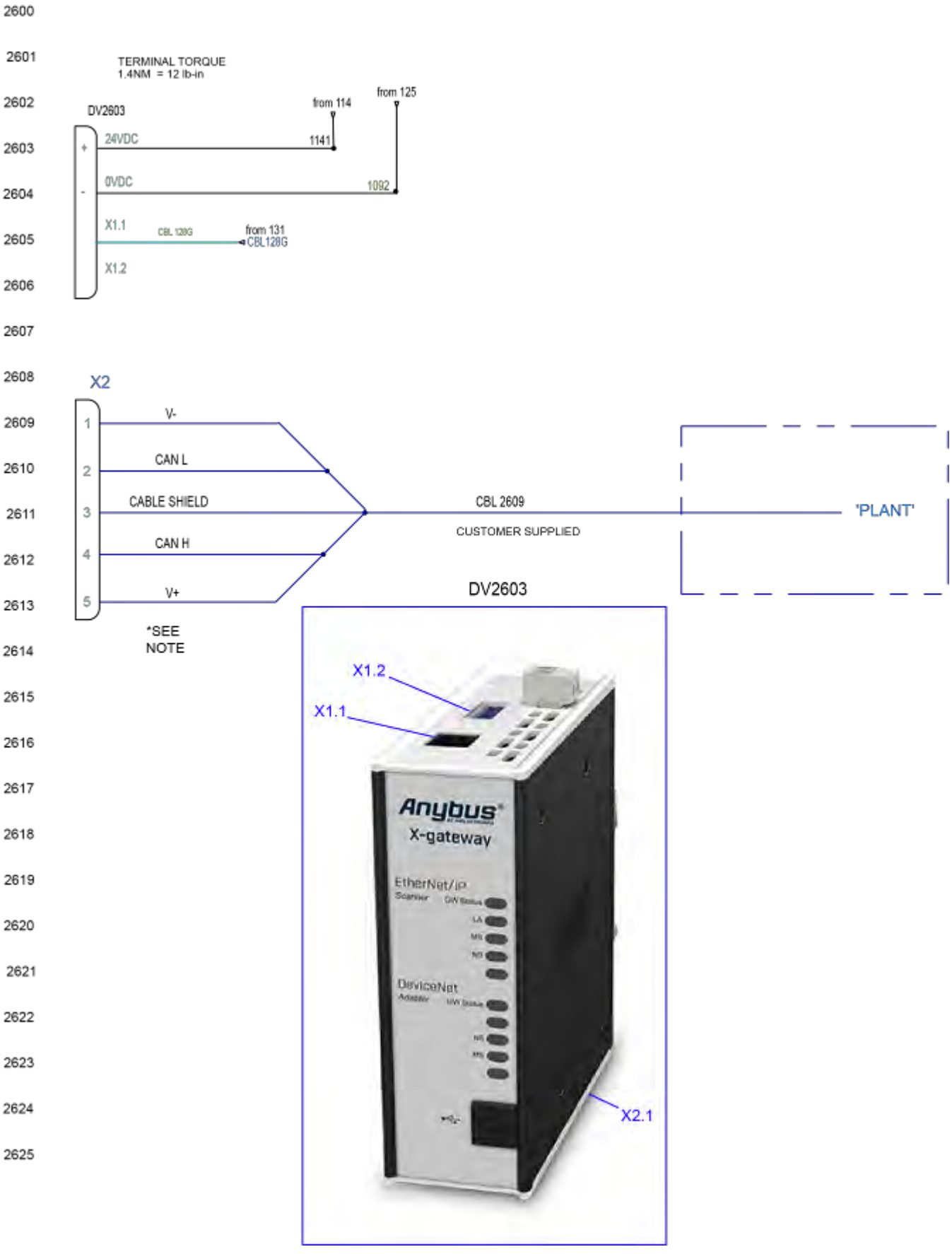
## DRAWING 26


TERMINAL TORQUE
1.4NM = 12 lb-in
DV2603
24VDC
0VDC
X1.1
X1.2
CBL 128G
from 131
CBL128G
from 114
1141
from 125
1092
DV2603-2
X2.1
X2.2
CBL 2609
BLKHD 2609
'PLANT' ETHERNET
DV2603
X1.2
X1.1
Anybus
X-gateway
EtherNet/IP
Adapter
EtherNet/IP
Adapter
X2.1
X2.2

## DRAWING 26 (cont.)

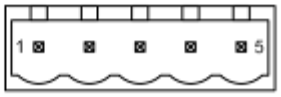


## DRAWING 26B


TERMINAL TORQUE
1.4NM = 12 lb-in
DV2603
from 114
from 125
24VDC
1141
0VDC
1092
X1.1
CBL 128G
from 131
CBL128G
X1.2
X2
V-
CAN L
CABLE SHIELD
CAN H
V+
CBL 2609
CUSTOMER SUPPLIED
'PLANT'
*SEE
NOTE
DV2603
X1.2
X1.1
Anybus
X-gateway
EtherNet/IP
DeviceNet
X2.1

## DRAWING 26B (cont.)

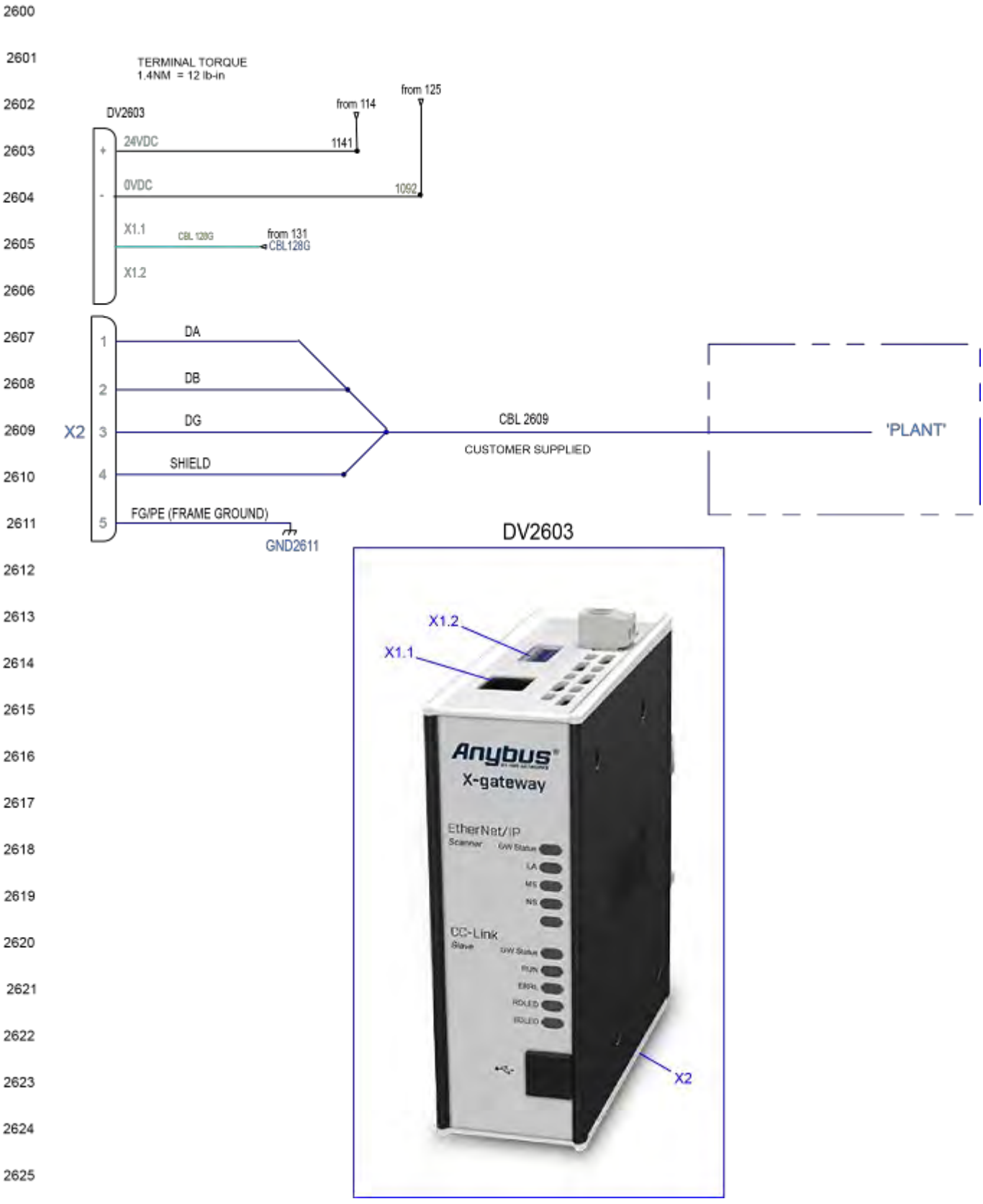

X2 DeviceNet Connector



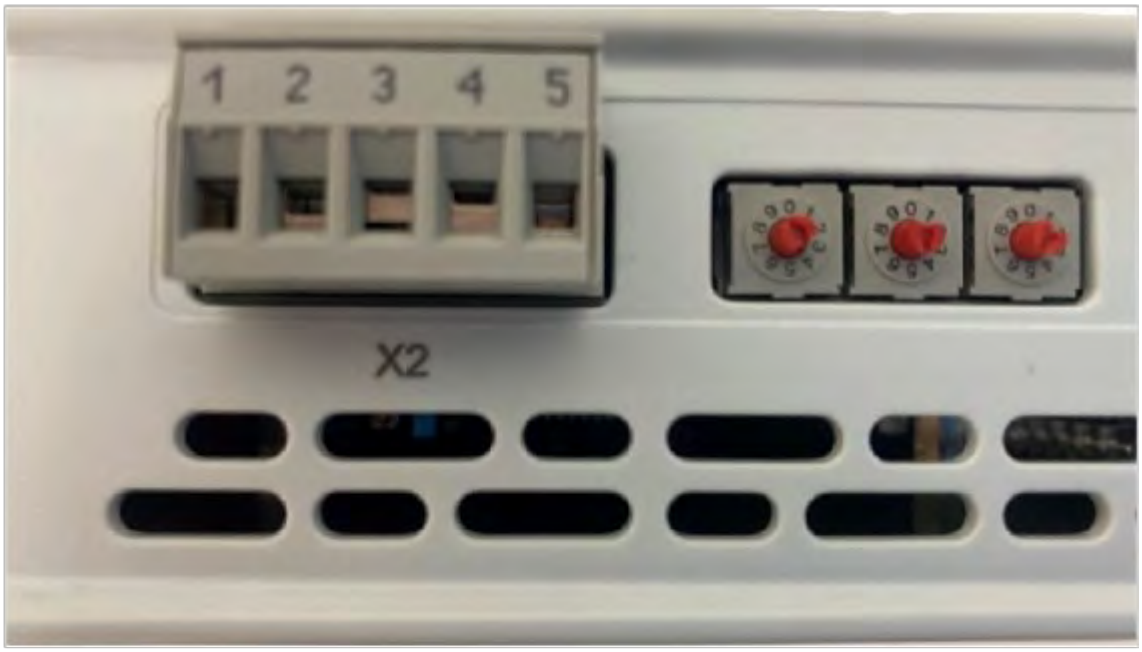

| Pin | Signal |
|---|---|
| 1 | V - |
| 2 | CAN L |
| 3 | Shield |
| 4 | CAN H |
| 5 | V + |

NOTE: A termination resistor of 121 Ohms, 1%, 1/4W must be attached at each end of the DeviceNet cable.
The resistors must be connected to pins 2 (Can L) and pins 5 (V+).

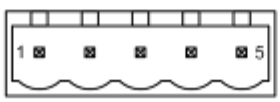
## DRAWING 26C


TERMINAL TORQUE
1.4NM = 12 lb-in
DV2603
from 114
from 125
24VDC
1141
0VDC
1092
X1.1
CBL 128G
from 131
CBL128G
X1.2
DA
DB
DG
SHIELD
FG/PE (FRAME GROUND)
GND2611
X2
CBL 2609
CUSTOMER SUPPLIED
'PLANT'
DV2603
X1.2
X1.1
Anybus
X-gateway
EtherNet/IP
Scanner
CC-Link
Slave
X2

## DRAWING 26C (cont.)

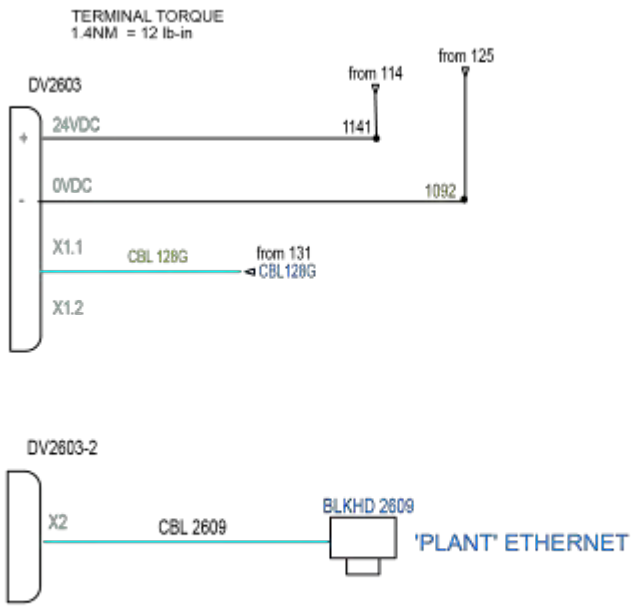



X2 CC-Link Connector



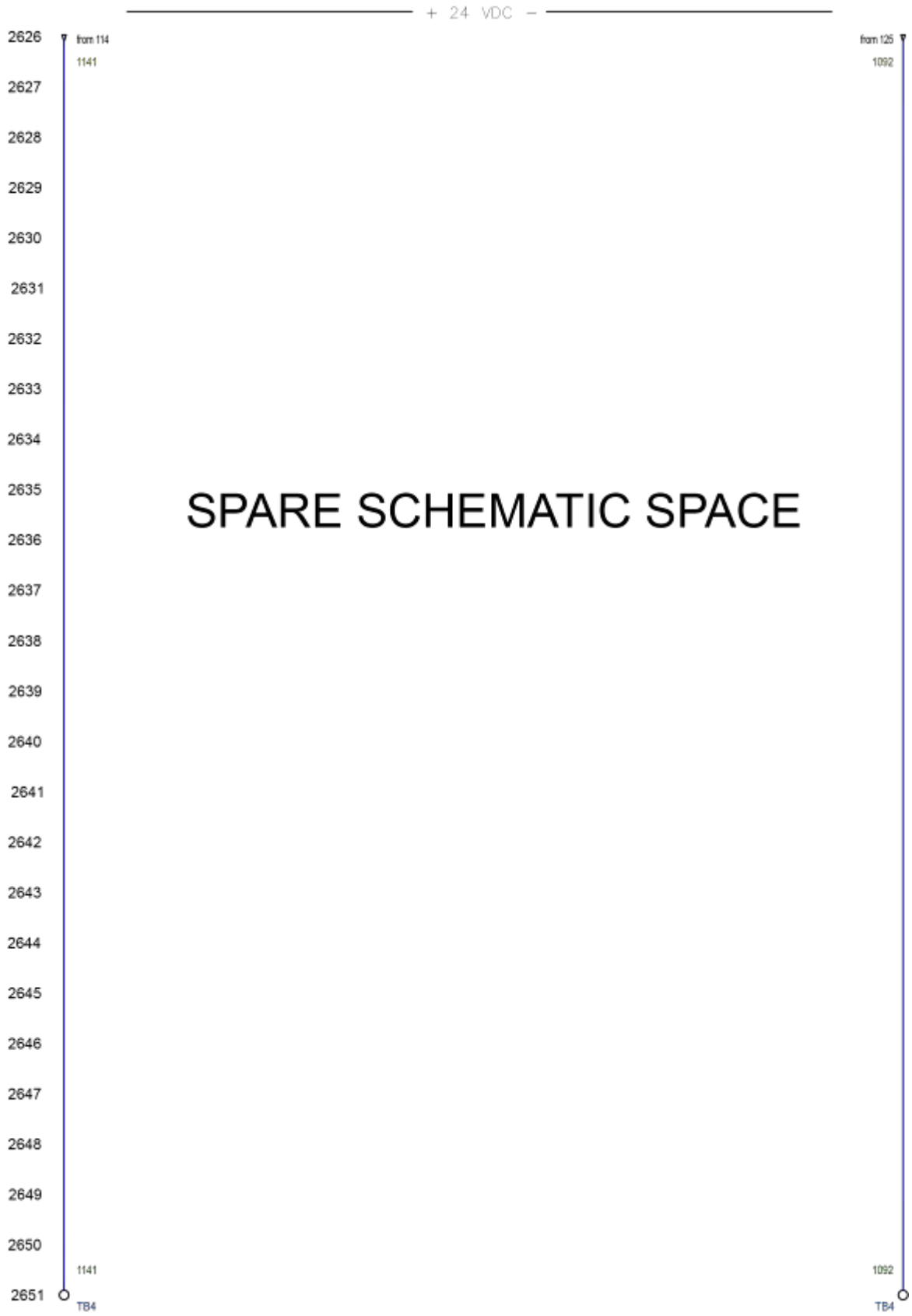

| Pin | Signal |
|---|---|
| 1 | DA (Communication signal) |
| 2 | DB (Communication signal) |
| 3 | DG (Digital Ground) |
| 4 | Shield (Cable shield) |
| 5 | FG/PE (Frame Ground) |

## DRAWING 26D

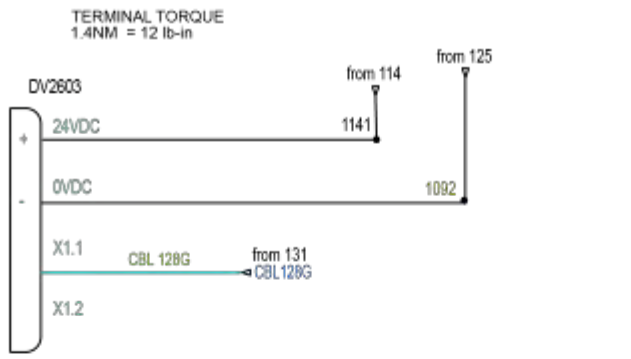


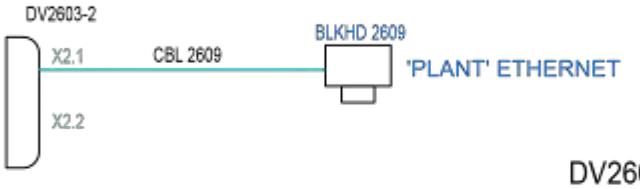

DV2603

## DRAWING 26D (cont.)



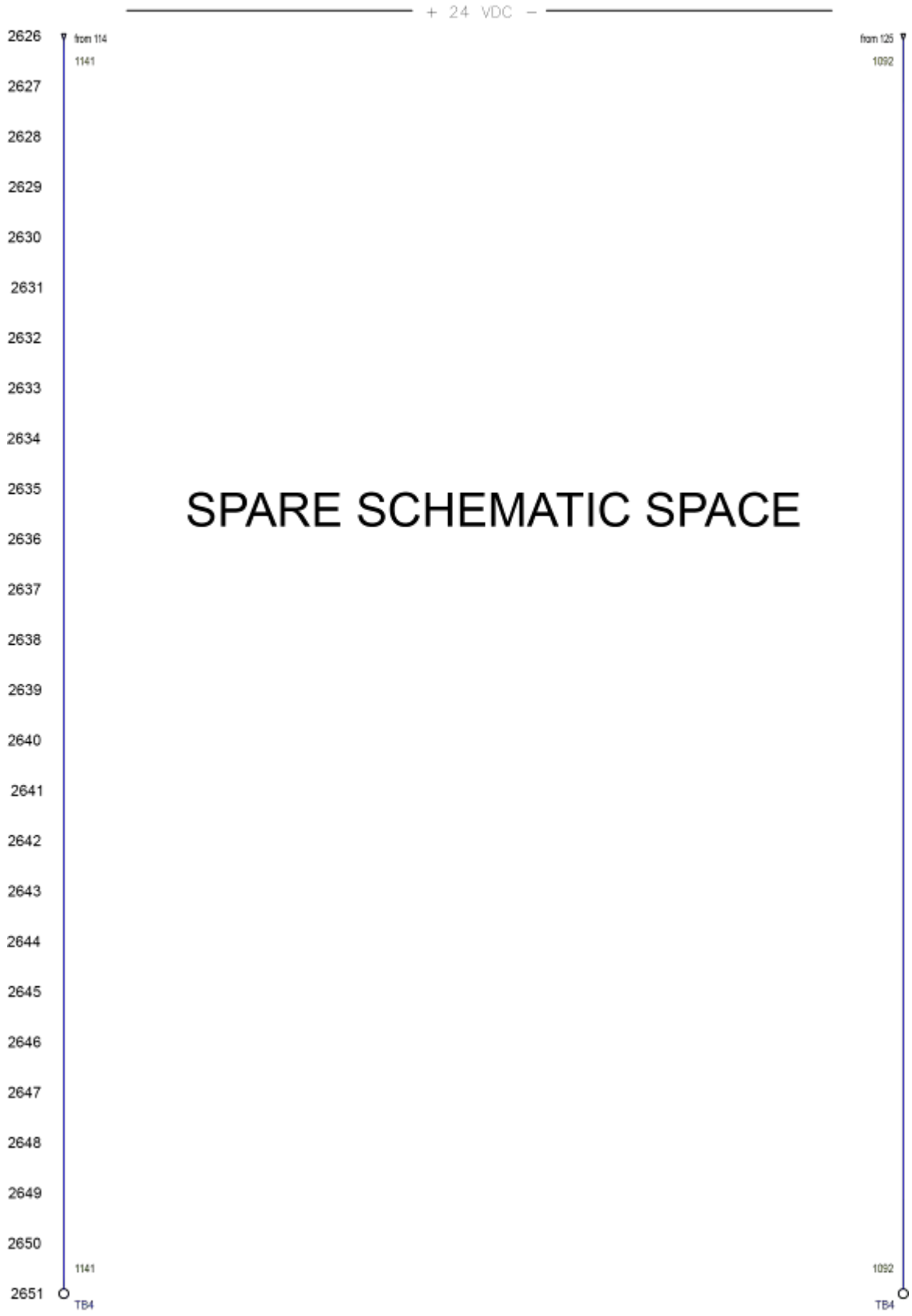
## DRAWING 26E




DV2603

## DRAWING 26E (cont.)



| Date | Changes | Version |
|---|---|---|
| 10/12/2021 | 1st Draft | R1 |
| 12/20/2022 | Added Rev. H electrical schematics (Appendix section) | R1 |
| 03/13/2023 | Added Rev. J electrical schematics (Appendix section) | R2 |
| 03/23/2023 | Added pulse valve adjustment and Cloud/Internet connection pages | R2 |
| 05/22/2023 | Added pressure limitations due to Coriolis. | R3 |

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