

Scully Intellitrol® 2

Technical Manual



Overfill Prevention Control Unit with Automatic
Ground Verification & Vehicle Identification Options



IEC 61508
Certified
SIL 2

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Introduction

Scully Signal Company was incorporated in 1936 with the invention of the Ventalarm Signal[®], a whistling tank-fill signal designed to replace float devices for high level liquid indication and overfill prevention. It was an immediate success in the United States and Canada and soon replaced unreliable floats in many tank applications.

Scully Signal Company then followed in 1950 with an Automatic and Continuous Self-Checking concept and patents. This brought a new level of fail-safe operations to Automatic Level Control and Overfill Prevention Systems with its "Dynamic Self-Checking[®]" patents and controls, which are installed worldwide with major oil and chemical companies plus military aviation refueling operations.

Scully's level controls check their own operation around the clock and have been applied to numerous monitoring operations in several industries such as flame safeguard control monitoring systems in refineries for both oil and chemical operations as well as top and bottom loading operations for terminals and tank trucks worldwide.

Summing up an astonishing fail-safe record worldwide in petrochemical operations this past quarter of a century, Dynamic Self-Checking, the electronic heart-beat system that fails safe **"unless incorrectly installed or deliberately bypassed!"**

Functional Safety

SIL - Safety Integrity Level, the latest industry standard in safety.

The Intellitrol is Scully's most advanced loading rack monitoring system. The Intellitrol2 has been evaluated by exida and certified as part of a SIL 2 Overfill Prevention System when used in conjunction with Scully Sensors. This functional safety assessment and certification is an IEC 61508 standard based evaluation of the safety equipment and its various failure modes. Scully's Dynamic Self-Checking design was key in the achievement of this first in the industry certification for road tanker overfill systems.

A SIL rating is based on an end to end assessment of a safety instrumented function or system. In an overfill system, such as the Intellitrol2, it includes all devices from the sensors to the control relay output of the Intellitrol2. Each device must have a published Failure in Time (FIT) number for both safe and unsafe failure modes. (See section 9.13 for Intellitrol2 FIT information.) In doing a functional safety calculation, failure contributions (FITS) of all system elements must be aggregated so an overall system prediction can be made and a Safe Failure Fraction (SFF) can be calculated. This information is required when determining a SIL level.

1.1 Description

The Intellitrol2 is intended to serve as a secondary overflow protection system for loading operations. It is intended for use in hazardous locations and is packaged in an explosion-proof (flameproof) enclosure and has both International and US approvals and certifications.

The Intellitrol2 performs a variety of monitoring functions and provides a number of outputs to control valves, pumps and other systems including Terminal Automation Systems (TAS). It has an integrated display to indicate system and monitoring status, a bypass capability, and communications for integration with TAS and other systems.

The Intellitrol2 contains a pair of microprocessors, each with its own relay, that monitors critical functions. Only when both processors detect a safe condition will both relays close and make outputs permissive.

The Intellitrol2 is designed to be Faysafe[®] and in the event of a failure (power, sensors, or internal electronics) the unit will enter a non-permissive (safe) state.

This state-of-the-art Dynamic Self-Testing[®] system controller provides overflow prevention, vehicle ground verification and vehicle identification operating in a single enclosure. The Intellitrol2 also provides the user with comprehensive diagnostic information, both locally on the exterior of the control unit housing and remotely to the terminal automation system via RS-485 communications.

1.2 Monitoring functions

1.2.1 Overflow

The Intellitrol2 monitors 5-wire optic sensors, 2-wire optic and 2-wire thermistor sensors that are compliant with EN13922 and API-1004 standards. The Intellitrol2 does not support 3-wire thermistor sensors such as the SP-BLH or SP-BLHK.

The system automatically determines which sensor type is attached. The Intellitrol2 is compatible with on-vehicle electronics like the Intellicheck and the Onboarder and interprets their output signals according to the interface used.

1.2.2 Ground

The Intellitrol2 can be configured via an internal jumper setting to monitor static ground verification based on:

- Ground Bolt/Ground Ball using Scully pioneered Dynamically Self-Testing[®] ground verification systems only or
- Automatic detection and reporting of the type of grounding. Either resistive ground or Ground Bolt/Ground Ball verification systems.

General

1.2.3 Vehicle Identification Prover

The Intellitrol2 is capable of monitoring Scully Truck Identification Modules (T.I.M.®s). The T.I.M. is a small truck-mounted device which gives every vehicle a unique identifier that can be read by the Vehicle Identification Prover (VIP) feature of the Intellitrol2. This identification can be compared to a programmable list stored in the non-volatile memory on the processor of the Intellitrol2 for a Go/No-Go decision or can be read by a Terminal Automation System (TAS) and used for other functions such as billing and automatic compartment size determination for loading using preset meters.

1.2.4 Deadman Function

The Deadman function has two modes – Standard and Active.

1.2.4.1 Standard Mode

The Standard mode behaves like all previous versions in that closing the Deadman switch will allow a permit if all other requirements have been met. Subsequently opening the switch for a short period of time, less than 3 seconds, will leave the system in permit. During the Open time, the green Permit bar will flash at 4 times the Dynacheck rate. If the switch is closed again before the 3 seconds, the permit will continue uninterrupted. If the switch is held open too long, the system will revert to non-permit, but permit can be re-established by simply closing the switch (again, that all other requirements have been met).

1.2.4.2 Active Mode

The Active Deadman mode is used to ensure that the system is being monitored by human interaction by requiring that the Deadman switch be periodically opened and closed using predefined settings. The Active feature is used per the following flow:

- Switch is closed to obtain permit (provided all other requirements are met).
- Switch must be opened before the Close time limit is reached, or the system will revert to non-permit.
- The switch must be closed again before the Open time limit is reached, or the system will revert to non-permit.

For the Scully Intellitrol Deadman feature, the following definitions are used:

- Close Time – The maximum length of time that the switch can remain closed before the system will revert to non-permit. This time is defaulted to 120 seconds.
- Open Time - The maximum length of time that the switch can remain opened before the system will revert to non-permit. This time is defaulted to 3 seconds.
- Warning Time - The length of time before the end of Close time that the system will flash the permit bar to warn the operator that the switch must be opened and closed. This time is defaulted to 15 seconds.

In the Active mode, if either the Close time or Open time limits are exceeded, the switch must be closed from an open state to re-establish permit. The switch must be held in the open or closed state for at least one second in order for the system to detect the state as valid.

In order to assist the operator in maintaining permit in the Active mode, the system will flash the permit bar as the Close Time nears the limit. This Warning Time is defaulted to start 15 seconds before the end of the Close time. Three different flash rates are used to notify the operator:

- With 15 seconds left the permit bar will flash at the Dynacheck rate.
- With 10 seconds left the permit bar flashes at twice the Dynacheck rate.
- With 5 seconds left the permit bar flashes at four times the Dynacheck rate.

The Deadman switch can be opened and closed at any time during the Permit, and the permit will be sustained as long as the time limits are not exceeded and the switch is held in each state for at least one second.

1.2.4.3 Deadman Function Selection

The Deadman option must be enabled by placing the Deadman jumper on the CPU board in the 'enabled' position (J5-3 to J5-4). After the option is enabled, the system defaults to the Standard Mode.

Enabling the Active mode must be done via a Modbus command by the Customer or Scully field personnel, and also requires the Deadman jumper to be in the Enabled position. Open time, Close time, and Warning time can also be modified using the relevant Modbus commands.

Please refer to the Scully MODBUS User Guide, Scully PN 43177, for highly detailed descriptions and usage of the Modbus commands.

1.2.4.4 Bypass During Active Deadman

The Warning flash will not occur if the system is in bypass mode for a sensor failure while using Active Deadman. In this case, the permit will simply stop once the time limit is reached. If the Active Deadman mode is being used in the case of a sensor bypass, it is suggested that the operator use some other timing method to ensure the switch is opened and closed before the limits are reached. If the system is in bypass mode for a ground or VIP fault, the Warning flash will display only for the last 5 seconds at the fastest rate.

Note: The form C relay use is restricted to only NO and common contacts when using the deadman input.

1.3 Output capabilities

1.3.1 Form A (Powered) Relay contacts (Faylsafe)

One set of fuse-protected relay contacts is available for output. These contacts are also used for internal monitoring of relays and must only be used for AC power switching. If a TAS requires voltage-free switching, the Form C contacts should be used. The Main Display on the front panel indicates relay status.

1.3.2 Form C (Volt free) Relay contacts (non Faylsafe)

A set of volt free contacts is available for low voltage switching applications. These contacts are switched together with the Form A contacts and cannot operate separately.

1.3.3 Good Ground or Truck Present (non Faylsafe)

A transistor switch is available to indicate that a good ground has been detected or that a truck is connected. Typical truck present use is to control a gate to prevent drive-offs while connected to the Intellitrol2.

General

1.4 Communications

The Intellitrol2 has an RS-485 interface which can be used to perform maintenance and serves as a communications interface for Terminal Automation Systems (TAS). Through this interface, the TAS can obtain Intellitrol status including truck present, sensor, and ground status as well as directly reading T.I.M. information. For more details on the operation of this interface please contact Technical Services for MODBUS User Manual (PN# 43177).

1.5 Bypass

The Intellitrol2 has the capability to bypass some fault conditions when connected to a vehicle. The bypass capability is accessed using a bypass key, sold separately. The bypass key serial number is compared to an internal list stored in non-volatile memory for authorization. If the key is authorized to bypass the unit, the Intellitrol2 will recognize it and bypass the fault (overfill, ground or vehicle ID). An overfill sensor that becomes wet while loading cannot be bypassed.

1.6 Additional Equipment

1.6.1 Sculcon Junction Box

A Sculcon Junction Box is highly recommended because it is used to interface between the Intellitrol2 intrinsically safe connections and a vehicle connection. It comes with a plug and cable assembly for truck connection. The Sculcon Box enables cable replacement without requiring that the Intellitrol door be opened or the seal on the Intellitrol2 door be broken.

1.6.2 Deadman Control Switch

A Deadman Control Switch is used with the Intellitrol2 when the operator must be present and actively involved at all times during the loading operation. The Deadman is optional.

1.7 Display Panel

The Intellitrol2 Display Panel is designed to be seen at the terminal by an operator located in the lane area of the tanker delivering or receiving a load. The display contains sections with unique functions which are listed in Figure 1.

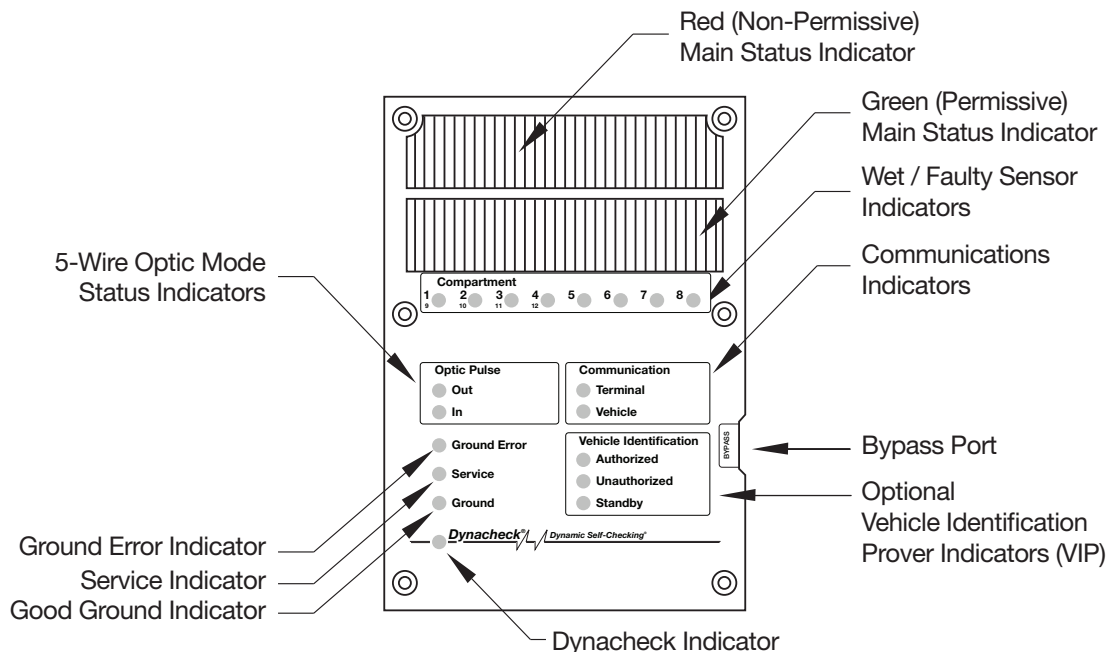


Figure 1: Main Status and Diagnostic Display Panel Indicators

1.7.1 Display Panel Indicators

Note: References below to flashing slow and fast are compared to Dynacheck® flash rate.

Main Status Bars

- **Red Bar On**, (Non-Permissive)
 - Flashing slow, faulty sensor bypassed
 - Flashing fast, main output relay shorted
- **Green Bar On**, (Permissive)
 - Flashing, ground or vehicle identification bypassed

Compartment Count (Up to 12 Compartments)

The Intellitrol2 will indicate the number of dry sensors (up to 12 compartments) on the truck. This count is displayed for the first 5 seconds after connection of a truck with dry 5-wire sensors. During this time, the Green Permissive lights will flash and the compartment LEDs indicating the number of compartments will flash.

For a number greater than 8, all 8 compartment LEDs will flash, alternating with the LEDs that indicate how many more than 8 compartments exist. The sum of the two numbers is the number of compartments on the truck.

For example, with 12 compartments, 1-2-3-4-5-6-7-8 will flash alternating with 1-2-3-4.

Compartment LEDs (Fault Indicators)

- **Off**, No truck/dry sensor
- **Red**, Wet or warming sensor
 - **Flashing slow** = open 2-wire sensor
 - **Flashing fast** = shorted 2-wire sensor

Note: When a compartment fault is detected:

A compartment LED that is on after the first 5 seconds of compartment counting indicates a fault in that compartment. It may be faulty wiring, thermistor sensors not warmed up, or wet compartments.

- For 2-wire only, 6 or 8 compartments are monitored, depending on jumper settings. LEDs on indicate that one or more compartments are faulty and corresponds with a non-permissive condition preventing product transfer.
- For 5-wire only, 1 to 12 compartments are monitored. LEDs on indicate the first faulty compartment and produces a non-permissive condition preventing product transfer. Compartments 1-8 are indicated by a single LED on. Compartments 9-12 are indicated by LED No.8 on plus one additional LED 1-4. Adding the two LED numbers, $(8+1) = 9$, and $(8+2) = 10$, and so on indicates which of the 12 compartments is faulty.

Ground, 2 LEDs

- **"Ground Error" - Red**, No ground connection detected, with vehicle connected
- **"Ground" - Green**, good ground connection detected
- **"Ground Error" FLASHING**, with vehicle connected, Ground verification function bypassed
- **Both Off**, No ground connection detected, no vehicle connected

General

Communication, 2 LEDs

- **"Terminal" - Yellow**, Communications in progress to TAS, Requires RS485 com link
- **"Vehicle" - Yellow**, Communications in progress to T.I.M., Requires VIP option

Optic Pulse, 2 LED's

- **"In" - Green**, Receiving pulses from 5-wire sensors
- **"Out" - Green**, Transmitting pulses to 5-wire sensor

Service, 1 LED

- **FLASHING Red**, Operational problem with the Intellitrol2

Dynacheck, 1 LED

- **FLASHING Yellow**, Normal operation, once per second
- **OFF**, Operational problem with the Intellitrol2

Vehicle Identification Prover, 3 LED's

- **"AUTHORIZED" - Green**, Truck Identification Module (T.I.M.) serial number has been read and found in authorization list.
- **Flashing Green**, VIP function bypassed
- **"UNAUTHORIZED" - Red**, Truck Identification Module (T.I.M.) serial number is not found in authorization list.
- **"STANDBY" - Yellow**, Truck Identification Module (T.I.M.) has not been read.

1.8 Approvals

All Intellitrol2 units fall under the approvals for:

- FM Approved for use in Canada and the United States
Rated: Class I, Division 1, Groups C and D, T4, 4X; with Intrinsically Safe outputs for connection to Class I, Division 1, Group C and D, and Class I, Zone 0, Group IIB.
Ta = -40°C to +60°C
- NEMA 4X rating, for either indoor or outdoor use and is Watertight, dust tight and corrosion resistant.
- ATEX:
- Ex d ia IIB T4 IP65 (Tamb = -40°C to +50°C) Gb
- IECEx Certification: GBBASExTR11.030500
Intellitrol2 Control Module & Display Board
Intellitrol2 ICC Control Module
Intellitrol2 ICC-SIL Control Module



1.9 Constraints

The Intellitrol2 Control Unit has been designed to be impact-resistant, however, do not subject it to excessive mechanical or thermal stresses. Do not allow the unit to come in contact with aggressive substances.

The Intellitrol2 may only be repaired by qualified technical personnel by replacing the internal control or display module with equivalent Scully modules. The internal control module and display board modules are not field repairable.

Do not open the Intellitrol2 door when an explosive gas atmosphere is present. To avoid static discharge buildup, clean only with a damp cloth.

1.10 Internal Architecture

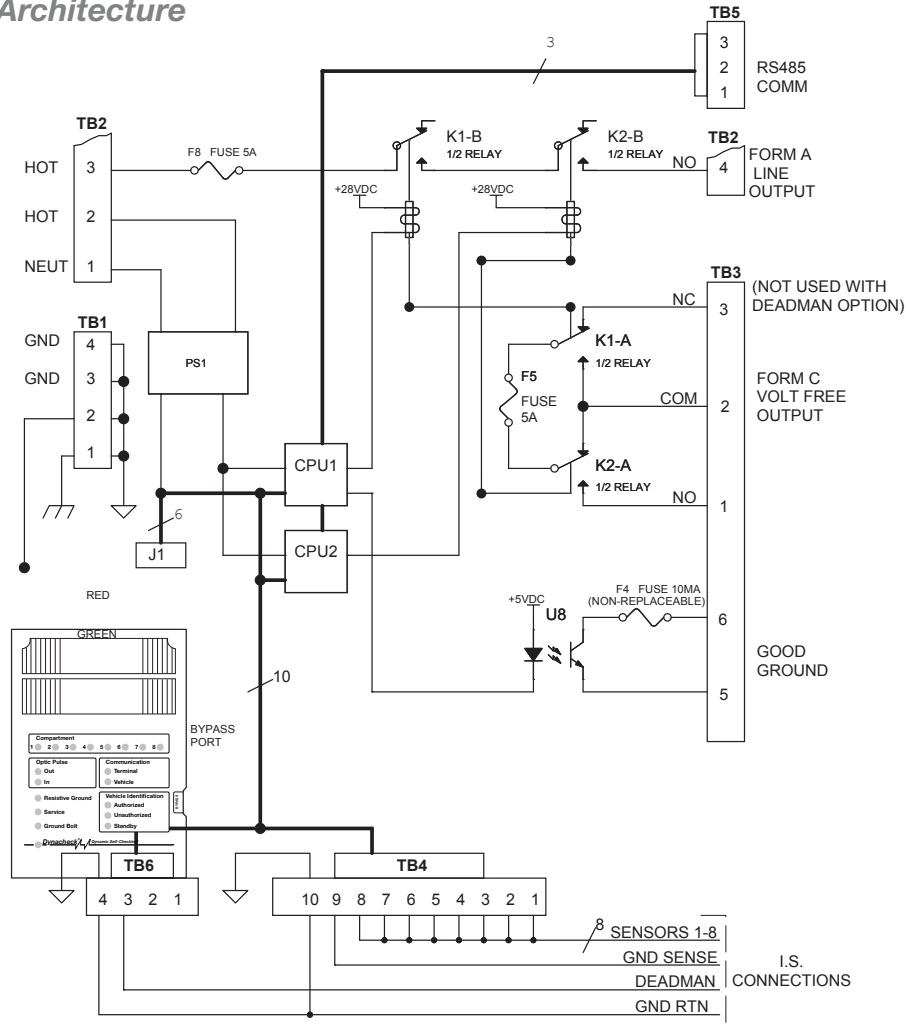


Figure 2: Intellitrol 2 Block Diagram

1.11 Technical Specifications

1.11.1 Temperature

Operating: -40 to +50 Degrees C
 (-40 to +122 Degrees F)
 Storage: -45 to +85 Degrees C
 (-50 to +185 Degrees F)

1.11.2 Power Requirements

Voltage: 230 V +/-10% 50Hz
 or
 120V +/- 5% 60Hz
 Consumption: 30 Watts maximum

1.11.3 Outside Dimensions

See Appendix 9.1 & 9.2 for mounting details.

1.11.4 Weight 14.1 kgs (31 lbs)

General

1.12 Configurations

The following models of the Scully Intellitrol2 are available internationally. All fall under Section 1.8 Approvals and Section 1.11 Technical Specifications.

1.12.1 European Table, ATEX

European series uses M25 X 1.5 (ISO) METRIC conduit entries.

Default Configuration: (230VAC)

<i>Model</i>	<i>Description</i>	<i>Part Number</i>
ICC2-OG	Overfill Prevention and Ground Verification	09547
ICC2-OGV	Overfill Prevention, Ground Verification and Vehicle Identification Prover	09548

1.12.2 North American Table, FM/CSA

North American series uses 3/4" NPT SAE conduit threads.

Default Configuration: (120VAC)

<i>Model</i>	<i>Description</i>	<i>Part Number</i>
IC2-OG	Overfill Prevention and Ground Verification	09549
IC2-OGV	Overfill Prevention, Ground Verification and Vehicle Identification Prover	09550

When choosing a location on the loading rack for the Intellitrol2, keep in mind that, while it can be exposed to the elements, the main status indicators and diagnostic display panel on the front of the Intellitrol2 should be readily visible and within easy reach to the user. The control unit should be mounted vertically, at eye level, in a location where the front cover can open 120 degrees for servicing.

Refer to the Intellitrol2 Enclosure Outline and Sculcon Plug and Cable Assembly Drawings in Appendices 9.1 - 9.3 for physical dimensions, location of mounting bolts, electrical gland/cable conduit entry locations, and enclosure bonding stud. The enclosure bonding stud is provided for proper electrical bonding (grounding) of the enclosure to earth ground. Use only the three conduit entry holes provided for wiring. The left and right side holes are for power and control wiring. The bottom hole is for intrinsically safe sensor wiring only.



ATTENTION: Do not drill any additional holes in the enclosure, as doing so violates the enclosure's hazardous location approval and voids the warranty.

ATTENTION: Ne pas percer de trous supplémentaires dans le boîtier, ce faisant, viole l'emplacement dangereux approbation et annule la garantie.

2.1 Warnings

- All electrical gland/cable conduit entries entering the enclosure must have a seal fitting installed within 18 inches (45.72 cm) of the enclosure to comply with the enclosure's approval requirements.
- The electrical gland/cable conduit entry in the bottom of the enclosure marked “Intrinsically Safe Entry” is for the sensor wiring between the Intellitrol2 plug and cable assembly and for the optional deadman switch wiring only. To maintain intrinsic safety, this gland/cable conduit entry must not be used for any other wiring.



ATTENTION: *Disconnect power before opening cover.*

ATTENTION: *Coupez l'alimentation avant d'ouvrir le couvercle.*



WARNING: *EXPLOSION HAZARD – DO NOT REPLACE THE MODULE UNLESS THE POWER HAS BEEN SWITCHED OFF OR THE AREA IS KNOWN TO BE NON-HAZARDOUS*

AVERTISSEMENT: *RISQUE D'EXPLOSION ne remplacez pas le module à moins que le courant a été coupé ou l'environnement est classé non dangereux*



WARNING: *Improper connections, component substitution or tampering may impair intrinsic safety and create hazardous conditions.*

AVERTISSEMENT: *des connexions mal effectuées, la substitution ou la manipulation des composants peuvent nuire à la sécurité intrinsèque et créer des conditions dangereuses.*

2.2 Water Proofing

To avoid future maintenance issues regarding water infiltration into the housing via the electrical gland/cable conduit entries, we strongly recommend the following precautions:

- Minimize long vertical gland/cable conduit runs into the sides of the enclosure as they promote water channeling to the gland/cable conduit seal fitting packing.
- Carefully install the cable conduit/glands on the sides of the enclosure, taking extra precaution to make certain that the installation is correct and sealed properly (as required by code).

2.3 European Installations

To maintain the flame proof rating of the enclosure, the cable gland fittings at all entries to the enclosure should be equipped with a fiber washer or o-ring between the cable gland and the enclosure to properly seal the threads against water infiltration.

2.4 North American Installations

To maintain NEMA 4X rating, all threaded joints of the conduits entering the enclosure must be sealed with a copper anti-seize/sealant or equivalent.

Refer to the Installation Wiring Diagrams for the Intellitrol2 Control Module and Sculcon Junction Box Plug and Cable Assemblies in Appendices 9.6 - 9.8.

Electrical Installation

3.1 Non-Intrinsically Safe (IS) Connections

All Non-IS connections are at the top of the control module and must never be intermixed with IS wiring.

3.1.1 Power Selection

The Intellitrol2 is field selectable for either 120 or 230 VAC by setting red jumper(s) J10 and J11 at the top of the board.

- **120 VAC**, Insert 2 horizontal jumpers, one in J10 and one in J11
- **230 VAC**, Insert a single vertical jumper between J10 and J11

Note: Refer to Appendix 9.10. See J10 and J11 configurations.

3.1.2 Ground

It is imperative to Intrinsic Safety that the unit be connected to earth ground. A green terminal block (TB1) is located at the top left of the control module to terminate an incoming ground connection. Do not modify the other connections on this terminal block.

- **TB1-1**, Green wire door ground
- **TB1-2**, Green wire box ground
- **TB1-3**, AC power ground
- **TB1-4**, Extra AC power ground

3.1.3 AC Power Connection

- **TB2-1**, Neutral
- **TB2-2**, Hot

3.1.4 Switched Outputs

Powered

- **TB2-3**, Power in
- **TB2-4**, Power out

These connections are used internally to monitor relay status and use a normally open switch for line voltage use.

Caution: Must be the same phase as the power in.

Must not be used for low voltage DC switching.

Unpowered

- **TB3-1**, Normally Open (NO)
- **TB3-3**, Normally Closed (NC)
- **TB3-2**, Common (COM)

This set of dry Single Pole Double Throw (SPDT) relay contacts are available for connection of low voltage devices. In the event of a failure all switched power and the NO connections of the unpowered output will fail safe. The NC contact of the unpowered output will remain closed should power be lost and is not fail safe. The NC contact should NOT be used for safety related functions.

3.1.5 Ground Permit or Truck Connected Status Output



NOTE: The Ground Permit or Truck Connect is not a Failsafe output. A single point fault can cause this output to fail.

- **TB3-6**, is the switched input
- **TB3-5**, Should be connected to the ground of the power supply supplying the switch input TB3-6, and **NOT the Intellitrol2 power supply**.

TB3-5 and TB3-6 are the terminal connections for the “Ground Permit” or “Truck Connected” output. This output, which is the transistor output of an optoisolator, conducts when a good ground is detected or if a truck is connected to the Intellitrol2, depending on the configuration. A jumper on J5 of the CPU PCB of the control module configures this output to operate either as a “Ground Permit” or “Truck Connected” output (see section 4.1).

This fully isolated output is designed to provide a control logic level signal to a Programmable Logic Controller (PLC) or a Solid State Relay. This output is capable of sinking up to 5 mA (milliamp). When the optoisolator is in the ON or conducting state, the maximum saturation voltage at rated current is 0.4 VDC. In the non-conducting or OFF state, the transistor is capable of withstanding up to 25.2 VDC. If the fuse opens the Intellitrol2 module will have to be returned for repair! This repair is not covered under the warranty.

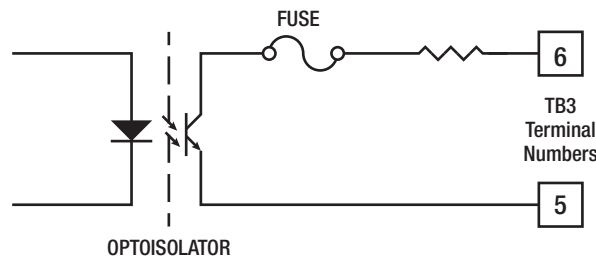


Figure 3



NOTE: TB3-5 should be connected to the ground of the PLC or solid state relay power supply, NOT to the Intellitrol2 ground!

The output TB3-6 is capable of providing enough current sinking capability to drive SOME low-current Solid State Relays. Some examples of both applications will be illustrated below. The circuit diagram is shown in Figure 3, for reference.

Electrical Installation

Some typical wiring diagrams to interface the “Ground Permit” or “Truck Connected” output to a Programmable Logic Controller’s (PLC) input channel (Figure 4) or a Solid State Relay (SSR) is shown in Figure 5.

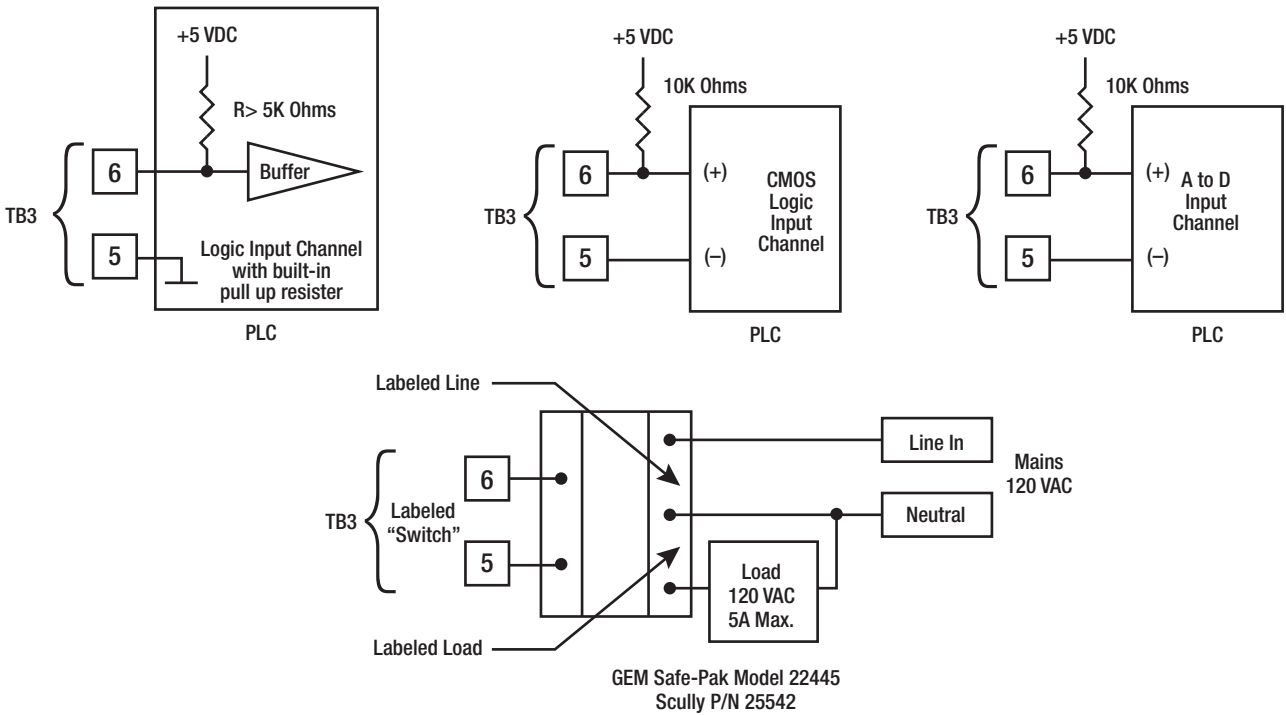


Figure 4

Figure 5, below, indicates a typical connection from TB3-5 and TB3-6 to an external Solid State Relay (SSR), powered by an external Relay Power Supply (+24 VDC). This external Relay Voltage may be provided by the PLC, or it may be a stand-alone power supply. An appropriate Load Power Source (AC or DC) should be selected to power the appropriate Load (AC or DC).

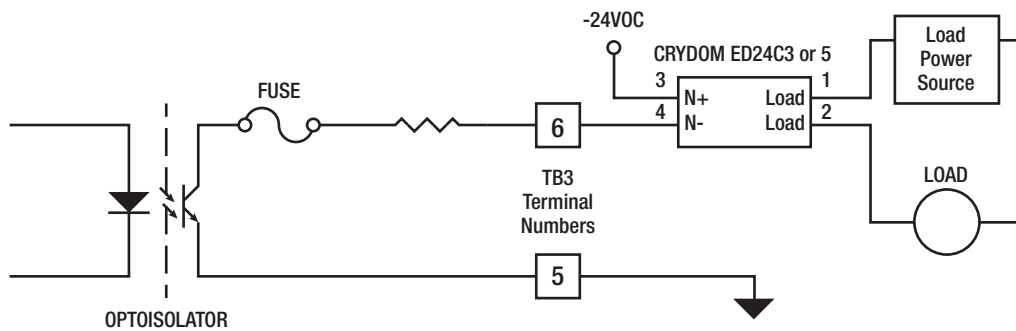


Figure 5

Some Solid State Relays (SSR) by different manufacturers can also be used. Typical, among these are the CRYDOM ED24C series. These choices are made to insure reliable operation of the Solid State Relays (SSR) by the Intellitrol2’s optoisolator, even with the current limiting resistor and the protective fuse in series with the optoisolator output transistor.



NOTE: DO NOT USE ELECTROMECHANICAL RELAYS. Typically, electromechanical relays draw a higher current than the 5 mA (MAX) that this output will safely provide.

In any case, the voltage drop across the internal resistor and fuse must be factored into the selection of any appropriate load to be attached. At a maximum allowed current of 5 mA., the voltage lost in the Intellitrol2 optoisolator output circuit will be equal to the current through the selected relay times 85 Ohms plus 0.4 VDC. This loss will occur if a Solid State Relay is connected.

The operating voltage for the connected load should be chosen to assure that:

(Relay Supply Voltage) – (TB3 voltage) > minimum turn on voltage and

(Relay Supply Voltage) – (required relay current X 85 Ohms) > minimum turn on voltage.

In any case, the open circuit control voltage for the relay MUST NOT EXCEED 25 VDC and the MAXIMUM SINK CURRENT MUST NOT EXCEED 5 mA. If the output is interfaced to a low voltage (typ +5 VDC) Programmable Logic Controller (PLC), none of these maximum conditions should present any problems. The pull-up resistors should be at least 5,000 ohms.

Please contact Scully Signal Application Engineering for assistance with any interface requirements or questions not covered by this section.

3.1.6 RS485 Communications Terminal

- **TB5-1**, ground terminal
- **TB5-2**, (TD/RD) “B” terminal
- **TB5-3**, (TD/RD) “A” terminal

Remote communications are available through connector TB5. Appendix 9.9 shows a typical Intellitrol2 multi drop communications wiring scheme for connection details.

While it is possible for an Intellitrol2 to share a RS-485 communications line with other equipment, we recommend a dedicated RS-485 communications line to simplify troubleshooting.

3.2 Intrinsically Safe (IS) Connections

Caution: DO NOT RUN WIRES connected to Intrinsically Safe connections next to Non Intrinsically Safe wires or connections. Doing so creates risk and an explosion may occur under adverse conditions.

All Intrinsically Safe (IS) connections are made through connectors TB4 and TB6 at the bottom of the box. Connections from TB4 are typically wired one-to-one from the Intellitrol2 to the terminal block in the Sculcon box. Different cable configurations are required for connection to 2-wire or 5-wire trucks.

Electrical Installation

3.2.1 Sculcon Junction Box Plug and Cable Assembly

The Sculcon Junction Box is the preferred way to connect to the IS-Interface. Refer to Appendix 9.3 for the typical Sculcon junction box outline diagram showing physical dimensions, location of mounting bolts and gland/cable conduit entry location details. Refer to Appendices 9.6 - 9.8 for wiring diagrams showing the interconnection details for the Sculcon junction box plug and cable assembly to the Intellitrol.

3.2.2 EN13922 Sensor Wiring Connections

- Both 2-wire and 5-wire trucks connect through a 10-pin plug and 10-pin connector (per EN13922)

3.2.3 API Sensor Wiring Connections

- 2-wire trucks use an 8- or 10-pin connector with 4 J-Slots on a 10-pin cable.
- 5-wire trucks use a 6-pin connector with 3 J-Slots on a 6-pin cable wired to the same connection.

Table 1 below describes the connections and function of TB4, Pins 1-10.

Connection	TB4 Pins									
Pin Number	1	2	3	4	5	6	7	8	9	10
2-Wire 8 Compartment	Sensor 1	Sensor 2	Sensor 3	Sensor 4	Sensor 5	Sensor 6	Sensor 7	Sensor 8	GND/ TIM Verify	GND
2-Wire 6 Compartment			Sensor 1	Sensor 2	Sensor 3	Sensor 4	Sensor 5	Sensor 6	GND/ TIM Verify	GND
5-Wire 12 Compartment				Pulse to Sensors	Diag.	Pulse from Sensors		Power to Sensors	GND/ TIM Verify	GND
Terminal Number	1	2	3	4	5	6	7	8	9	10
Connection	Sculcon Junction Box & Cable Plug Pin / Socket Receptable									

3.2.4 Deadman Control

- TB6-3, Normally Open (NO)**, Deadman Switch Input
- TB6-4**, Return

This Normally Open (NO) connection can optionally be used for a Deadman (switch closure) input signal.

3.2.5 J1 Front Display Panel Connection

J1 is located at the bottom left corner of the control board. J1 is a 6-pin ribbon header that provides an IS connection from the controller to the Front Display Panel.



CAUTION: Make sure to note the orientation of this connector before removing.

ATTENTION: Assurez-vous de noter l'orientation de ce connecteur avant la dépose.

3.3 EMI Shield Kit Installation Instructions

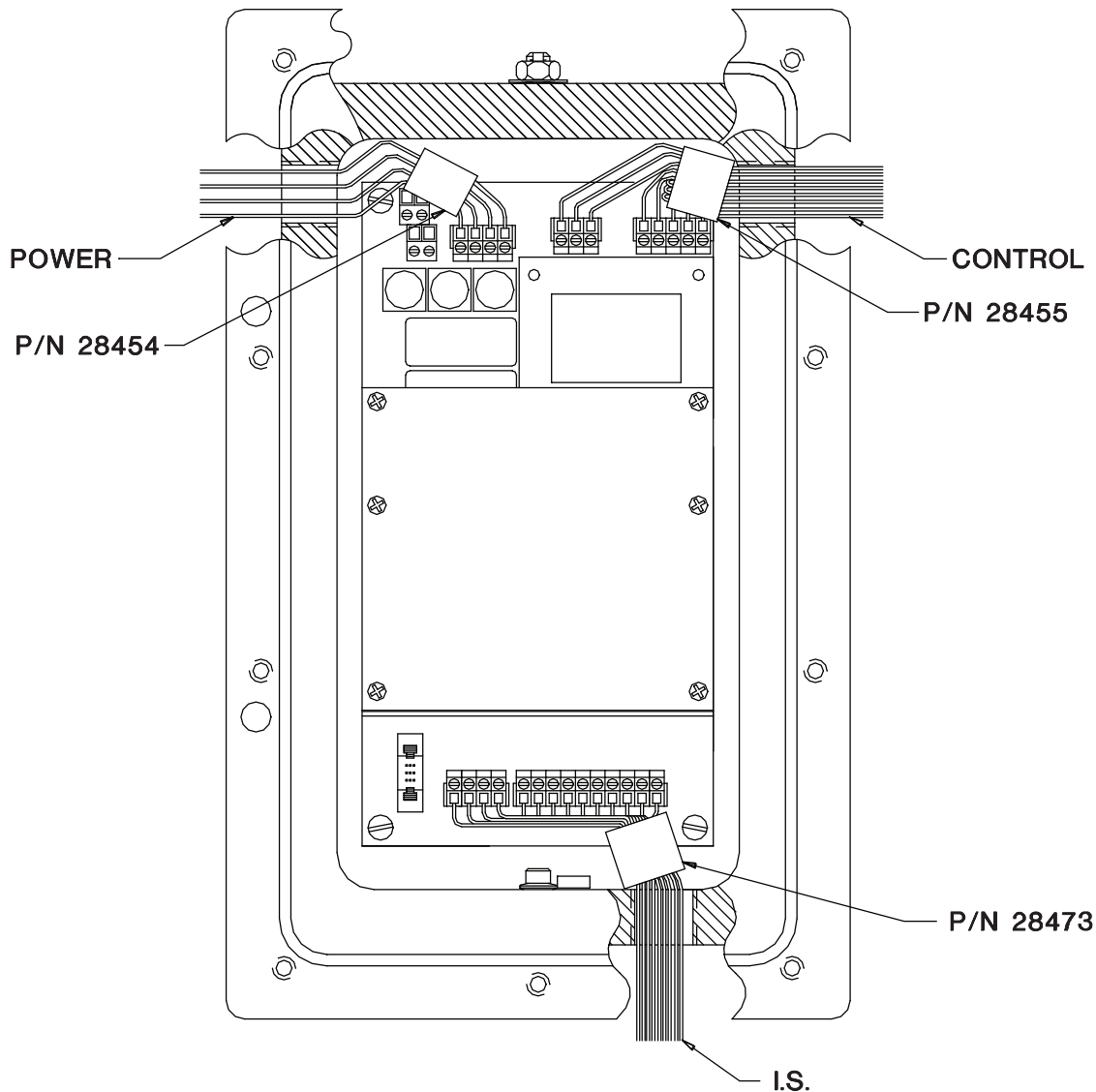
In order to minimize Electro Magnetic Interference (EMI), ferrite filters need to be installed on the three access cables entering the Intellitrol2 Controller. To reduce susceptibility to external EMI, the snap-on ferrite filters should be installed after the wiring connections are completed inside the Intellitrol2 . Make sure to leave only enough wire near the connectors to accommodate the snap-on ferrites.

Simply snap one EMI filter over all of the wires exiting the control box in all three locations shown.

Control Module:

1. Power in is on the left side
2. Control out/Modbus is on the right side
3. I.S. wiring is at the bottom

KEEP ALL LEADS AS SHORT AS POSSIBLE



System Setup

4.1 CPU Jumper Settings

The Intellitrol2 has a number of features and functions that can be enabled through internal jumper settings. The jumpers on the CPU board are listed below.

4.1.1 Jumper Selectable Options

- **J5** OPERATING MODE SETTINGS (see 4.1.2)
- **J8 & J1** COMM MODBUS ADDRESS (see 4.1.3)
- **J7** COMM PROTOCOL (see 4.1.4)

4.1.2 J5, OPERATING MODE SETTINGS

Enable/Disable (purchased options only).

Moving the jumper for a non-purchased option to the enable position will have no effect.

J5			Function Name	Description
1	-	2	TB3-5/6 CONFIG	Configures TB3 Pins 5-6 to indicate Good Ground (installed) or Truck Present (open)
3	-	4	DEADMAN ENABLE	Enable Deadman Switch Input
5	-	6	DEADMAN DISABLE	Disable Deadman Switch Input
7	-	8	VAPOR ENABLE	Not Used
9	-	10	VAPOR DISABLE	Not Used
11	-	12	VIP ENABLE	Enable Vehicle Identification Proving
13	-	14	VIP DISABLE	Disable Vehicle Identification Proving
15	-	16	GND ENABLE	Enable Ground Proving
17	-	18	GND DISABLE	Disable Ground Proving
19	-	20	ADD KEY S/N	Add Bypass Key Serial Number
21	-	22	NORMAL OPERATION	Normal Operation
23	-	24	ERASE KEY LIST	Erase Bypass Key Serial Number List

Note: The last three jumpers control Enrolling Bypass Key serial numbers into the Intellitrol2's nonvolatile memory. Refer to Section 4.3 for more detail.

4.1.3 J1 & J8, COMM MODBUS ADDRESS

Setting communications speeds and feeds

Two sets of jumpers are used for setting the Modbus address. Jumper J8 sets the tens group and jumper J1 sets the ones group. The Modbus address is the sum of the two jumpers.

4.1.4 J7, COMM PROTOCOL

RS485 (J7 Jumper Setup)

- **J7**, allow the user to select:
 - **Parity**, (NONE/ODD/EVEN)
 - **Baud Rate**, (1.2, 2.4, 4.8, 9.6, 19.2 KB/S)
 - **Data Pack**, (7 or 8 Bits)

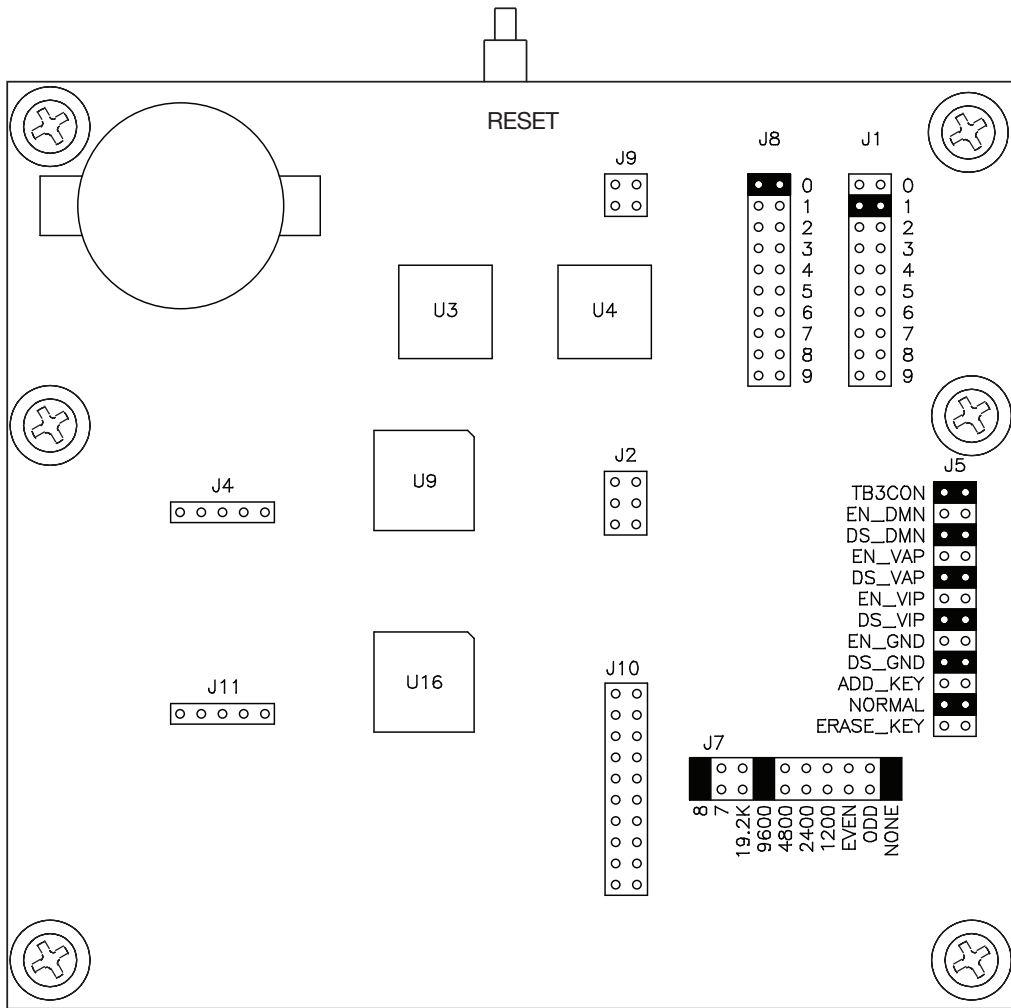


Figure 6: CPU Board Layout

Note: Jumper Terminals: Black denotes default installed jumpers, except J5 operating mode settings which are dependent on options purchased.

System Setup

4.1.5 Control Board Jumper Settings

Several modes can be selected using jumpers on the main Control Board.

Note: Refer to Appendix 9.9 for jumper locations on the Intellitrol2 Control Module.

CHANNEL, (Number of Compartments)

- **J31, Blue**
 - Sets 6 channel mode for 2-wire Sensors
- **J32, Blue**
 - Sets 8 channel mode for 2-wire Sensors

GND BOLT/BALL OR AUTOMATIC GROUND TYPE DETECTION

(Type of ground system check)

- **J8, Black**
 - Inserted sets automatic ground type detection; otherwise ground bolt/ground ball

THRESHOLD

- **J4, Black**
 - Inserted sets thermistor threshold = 3.8V for SP-BLK & BLUK type sensors; otherwise thermistor threshold = 3.5V SP-BL & BLU type sensors. (Default for ICC systems is the jumper inserted.)

JUMP START

- **J21, 22 and 23, Red**
 - Inserted disables Jump Start, limiting IS output voltage for ATEX applications. All three MUST always be in for ATEX installations. Otherwise remove the three jumpers to enable Jump Start for installations requiring preheating of thermistor sensors.

4.2 VIP List

The VIP feature is optional and must be ordered. Trucks and Tankers can be outfitted with a Truck Identification Module (TIM) that gives the vehicle a unique serial number. These numbers may be stored on the Intellitrol2 in non-volatile RAM so that the information may be passed to a terminal controller that works in conjunction with the Intellitrol system. The serial numbers must be entered into the Intellitrol via the RS-485 communication port.

4.3 Bypass Key, Add/Erase Procedures

Before use, each Bypass Key must first be programmed into the Intellitrol2's permanent memory. Power must be on.



WARNING: The following procedure must not be performed in a flammable hazardous environment. The Intellitrol2 door cannot be open while fuel or a tanker carrying flammable substances is present.

AVERTISSEMENT: La procédure suivante ne doit être effectuée dans un inflammables environnement dangereux. Le Intellitrol2 porte ne peut être ouverte pendant que le carburant ou d'un navire-citerne transportant substances inflammables est présent.

4.3.1 Adding Bypass Key entries:

1. Unbolt and open the Intellitrol2 door. Store the bolts in a safe place.
2. Move the "NORMAL" jumper on J5 to the "Add Key S/N" position (refer to Figure 6: CPU Board Layout).
3. Push the "Reset" button (top center of CPU board).
4. Close the door and wait for both Optic Pulse and Communications to blink together continuously at double the Dynacheck rate. The Intellitrol2 is now ready for entering a bypass key serial number.
5. Position a bypass key up to the bypass port. The Intellitrol2 will read the bypass key serial number incrementing the "Compartment Number" LED. After all 8 compartment LED's light up, the large green permissive light will flash briefly to indicate that the bypass key serial number has been stored in memory.
6. To add additional bypass keys, repeat Step 5 above. When all bypass key serial numbers have been added, proceed to Step 7.
7. Open the Intellitrol2 door and return the jumper on J5 to the "NORMAL" position.
8. Push the "Reset" button.
9. Close and properly secure the Intellitrol2 door using the original bolts.

4.3.2 Erasing Bypass Key entries:

It may at some point be necessary to delete the list of "authorized" Bypass Key serial numbers stored within the Intellitrol2's permanent memory (i.e. if a Bypass Key is lost). To delete the list of "authorized" Bypass Keys, do the following:



WARNING: *The following procedure must not be performed in a flammable hazardous environment. The Intellitrol 2 door cannot be open while fuel or a tanker carrying flammable substances is present.*

AVERTISSEMENT: *La procédure suivante ne doit être effectuée dans un inflammables environnement dangereux. Le Intellitrol2 porte ne peut être ouverte pendant que le carburant ou d'un navire-citerne transportant substances inflammables est présent.*

Caution: *All bypass key entries will be erased.*

1. Unbolt and open the Intellitrol2 door. Store the bolts in a safe place.
2. Move the "NORMAL" jumper J5 to the "ERASE_KEY" position (refer to Figure 6: CPU Board Layout).
3. Push the "Reset" button (top center of CPU board).
4. The large red non-permissive indicator will flash briefly and the Compartment, Optic Pulse, and Communication LED's will blink at double the Dynacheck rate to indicate that all bypass key entries have been deleted from memory.
5. Return the jumper on J5 to the "NORMAL" position.
6. Push the "Reset" button.
7. Close and properly secure the Intellitrol2 door using the original bolts.

4.3.3 External Bypass key entry/deletion

Bypass key serial numbers may be added or deleted one by one from the Intellitrol2 remotely via external software through the communications port.

Initial Systems Check

Performing an Initial System Check is essential and proves that the Intellitrol2 installation is performing safely and correctly.

5.1 Inspect Wiring

1. All electrical gland/cable conduit entries must have a seal fitting installed within 18 inches (45.72 cm) of the enclosure to comply with approval requirements.
2. The electrical gland/cable conduit entry in the bottom of the enclosure marked “Intrinsically Safe Entry” is for the sensor wiring between the control unit plug and cable assembly and for the optional deadman switch wiring only. To maintain intrinsic safety, this gland/cable conduit entry must not be used for any other wiring.
3. Inspect all field wiring for neat professional installation, and adherence to all wiring instructions above. Verify that all wiring terminals are tightened securely by tugging on each connection. Close the control unit's cover and fasten securely. Tighten the cover bolts in a criss-crossing pattern.

5.2 Recommended Test Equipment

While use of Scully Signal Company test equipment is not required, It is recommended. The test equipment provides all of the proper overfill prevention system signals required to verify the new installation without requiring actual vehicles for the testing.

5.3 Scully Rack Tester Model 09832

The Scully Rack Tester is a portable, self-contained device which incorporates a number of switches, connectors, and all required circuitry necessary to simulate 2-wire optical, 5-wire optical, and thermistor sensors, ground, and TIM functions required to verify proper Rack operation. The Scully Rack Tester is designed with intrinsically safe outputs and is certified to operate in Division I and Zone 0 hazardous locations.

The use of this tester is much like the ST-2-DSWJ with switches replacing buttons and including optical 2-wire sensors in addition to thermistors. A notable difference is the Intellitrol2 light indicators match the tester switch numbers in an 8 compartment configuration. In a 6 compartment configuration, switch 3 matches indicator 1.

5.4 Model ST-2-DSWJ Tester

The Model ST-2-DSWJ Tester provides a rotary switch to select the following functional safety checks:

- Cable Continuity
- Float Switch Detection
- Thermistor Sensor Detection
- Optical Sensor Detection

5.4.1 Operational Testing Sequence

1. No vehicle or tester connected to Intellitrol2.
2. Power up Intellitrol2.
3. Intellitrol2 will go through a power up sequence, including the testing of all internal functions and operating parameters.
4. Checks and enables display panel LED's in sequence.
5. Red non-permissive indicator will light after 15 seconds.
6. Yellow Dynacheck LED will flash indicating that the Intellitrol2 is ready to accept a vehicle. If the Intellitrol2 is connected to a terminal automation system, the yellow terminal LED will also flash each time the Intellitrol2 is polled by the automation system.

5.4.2 Equipment Attachment

Set the ST-2-DSWJ tester to Thermistor Sensor Detection mode. Attach the black or green 2-wire thermistor or 2-wire optic plug from the Intellitrol2 to the 2-wire thermistor or 2-wire optic socket (SJ-8S-2 bayonet pin style) on the right side of the housing.

5.4.3 Two-Wire Thermistor Sensor Operation Testing

The ST-2-DSWJ tester uses one "Channel Test" button/switch per thermistor sensor and each corresponding sensor will be tested when that button is depressed.

When the tester is attached to the thermistor socket, the Intellitrol2 will detect that it is attached to a "thermistor" equipped vehicle and proceed to warm up the sensors (the tester has traditional thermistor sensors inside). While the sensors are warming up, the 6 (or 8) red compartment indicator lights at the top of the Intellitrol2's diagnostic display panel will light, indicating 6 (or 8) wet sensors. As each thermistor sensor warms up, the red compartment indicator, corresponding to that sensor, will go out indicating a dry sensor. When all of the thermistor sensors are warmed up (up to 75 seconds required) the Intellitrol2 will permit, and the green main status indicator will come on. Verify that the Intellitrol2's main output relay contact has closed (turned on) and that product can be transferred. This can be done by verifying that this permissive signal is available at the product meter(s) external permissive input terminal(s). Some metering systems also have a visible indicator (LED) to indicate that the external permissive signal is satisfied.

For each thermistor sensor selected, verify that the Intellitrol2 goes non-permissive and shuts down the Rack/Gantry. For a 6 compartment configuration, the corresponding compartment indicator light on the Intellitrol2 diagnostic display panel will light when the test button/switch is pushed. For an 8 compartment configuration, the button 3 matches Intellitrol2 indicator 1 and the buttons and indicators follow in sequence from there. If more than one plug (or two different styles of plugs) is used on this installation for 2-wire thermistor or 2-wire optic operation, repeat the above tests for the other plug.

Initial Systems Check

5.4.4 Five-Wire Optic Sensor Operation Testing

Set the ST-2-DSWJ tester to Optic Sensor Detection mode. If the installation uses a single plug for both 2-wire thermistor or 2-wire optic and 5-wire optic modes, leave the plug connected as per the above. If the installation uses separate plugs for 2-wire thermistor or 2-wire optic and 5-wire optic operating modes, attach the optic plug from the Intellitrol2 to the optic socket. This will be either the SJ-6W-3 bayonet pin style socket on the left side of the housing for a blue "6W" style optic plug, or the SAE J- 560 style socket on the back of the tester housing for a "6X" style optic plug. When attached to this optic socket, the Intellitrol2 will detect that it is attached to a 5-wire optic equipped vehicle and proceed immediately to permit. The Intellitrol2's diagnostic display panel will light, indicating an "optic out" pulse from the Intellitrol2 and an "optic in" pulse from the tester. As the Intellitrol2 permits, the green main status indicator will light up. Verify that the output to the metering system again turns on and that product can be transferred. Verify that when push-button/switch no. 2, no. 4 or no. 6 on the tester is pushed, the Intellitrol2 goes non-permissive and shuts down product flow. Compartment indicator light no. 1 on the Intellitrol2 diagnostic display panel will light when one of these tester buttons is pushed.

5.5 Fault Conditions

If the Intellitrol2 fails the power up diagnostic test, the Service LED will flash ON-OFF and the Dynacheck light will be off. After making sure that the Intellitrol2's plug(s) are not connected to a truck, remove power from the unit for 15 seconds and reapply. If this does not correct the problem, refer to the Troubleshooting Chart in Section 7.3. There can not be a vehicle attached to the Intellitrol2 during power-up (or during a reset). If there is a vehicle attached during power-up, the Intellitrol2 will fail its diagnostic tests.

If the Intellitrol2 does not permit the tester in either of the above modes, refer to the diagnostic display panel for specific information on identifying the cause of the problem. Most of the detailed instructions and cautions for operation of the Intellitrol2 system and accessories have already been discussed. The basics of loading a vehicle are described below. Refer to Figure 7 for details of the Intellitrol2's main status indicators and diagnostic display panel.

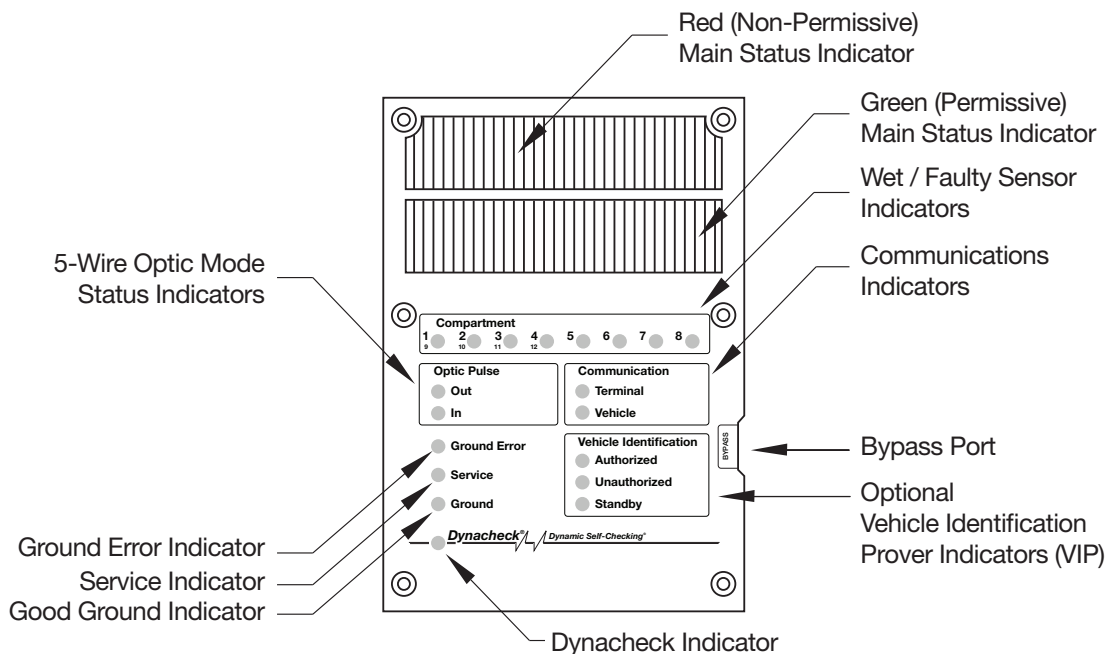


Figure 7: Main Status and Diagnostic Display Panel Indicators

6.1 *Normal Loading*

The Intellitrol2 is capable of automatically detecting the presence of 2-wire and 5-wire overfill sensors. In operation it constantly monitors the truck plug while running diagnostics. Once a truck is detected the system determines the sensor type and monitors for dry condition.

Optic sensors are detected within a second. Thermistor sensors must heat up before indicating a dry condition. The heat-up time for thermistor sensors can take up to 75 seconds. This is a normal condition.

6.2 *After a Normal Load*

Disconnect the plug from the vehicle to be loaded. The Intellitrol2 will return to its non-permissive state and the diagnostic display panel will first flash all of the 8 compartment indicators and then clear (go blank) within a few seconds. This indicates that the Intellitrol2's plug is ready to be connected to the next vehicle.

6.3 *Intellitrol2 Not Permitting*

If the Intellitrol2 main display does not go green, the reason for the problem will be indicated in the front panel display (see Section 7.3 Troubleshooting Chart for details). A faulty or unauthorized TIM, a faulty ground condition and wet or faulty compartment sensors at connection time are indicated on the front panel by red LEDs being illuminated. These conditions can be bypassed with the use of a properly registered bypass key.

All indicators will look correct when the non-permit is due to the deadman switch. The deadman cannot be bypassed.

6.4 *Bypassing Fault Conditions*

6.4.1 *Bypassing in General*

When blinking green the ground or VIP is bypassed or the active deadman switch is nearing the end of its close time and must be opened to prevent a non-permit. The bypass blink is at a slow rate and the LEDs are on for $\frac{3}{4}$ of the blink, the deadman blink is fast and the on and off times are equal.

System Operation

6.5 Grounding

The Intellitrol2 ground detection is dependent on the proper wiring of the vehicle being loaded. This requires that the vehicle rack connection socket have pins 9 and 10 independently connected to the vehicle chassis. Use of a Scully ground bolt, mounted on the vehicle chassis, ensures a good ground connection is in place.

When a ground bolt is not used the EN 13922 standard is that pin 9 of the connection socket is connected to the vehicle chassis through the socket mounting bolt and pin 10 is connected to the chassis by hardwiring.

It is recommended that a Truck Identification Module (T.I.M.) be used only in conjunction with a ground bolt. To prevent false ground detection through the T.I.M. rather than the ground bolt the automatic ground detection must be turned off by removing J8, or the T.I.M. ground wire must be connected to the chassis separate from the pin 10 connection.

Correct T.I.M. wiring without a ground bolt requires the T.I.M. be connected between pin 9 and the chassis separate from the pin 10 connection to chassis. Only a small amount of resistance in this connection will result in T.I.M. communication failures.

Corrosion and debris are common causes of grounding problems. Connection points to the chassis should be examined and cleaned if necessary to resolve these problems. The socket enclosure may need to be removed for this.

7.1 *Preventative Maintenance*

The Intellitrol2 should be inspected annually. The o-ring and corrosion pack should be replaced at this time. It is recommended that maintenance on Scully equipment be carried out by Scully certified technicians.

7.2 *Functional Safety Proof Testing*

It is a requirement of the Functional Safety certification that periodic proof testing be performed. Refer to the Intellitrol2 Safety Manual for the recommended test methods and frequency.

7.3 *Warranty*

7.3.1 *Intellitrol2 Control Unit*

The Intellitrol2 Control Unit is warranted by Scully Signal Company ("Scully") to be free from defects in material and workmanship under normal use and service for a period of three years. Warranty covers manufacturing defects. Damage specifically resulting from improper use or incorrect installation is not covered.

7.3.2 *General Terms*

All equipment returned to Scully that has a manufacturing date code that exceeds the warranty period should be accompanied by an invoice or work order that states the date of installation. Under these warranties, Scully shall be responsible only for actual loss or damage suffered and then only to the extent of Scully's invoiced price of the product. Scully shall not be liable in any case for labor charges for indirect, special, or consequential damages. Scully shall not be liable in any case for the removal and/or reinstallation of defective Scully equipment.

These warranties shall not apply to any defects or other damages to any Scully equipment caused by misuse or negligence, and this warranty shall not apply to any Scully equipment that has been altered or tampered with by anyone other than Scully factory representatives.

These warranties are the only warranties, expressed or implied, upon which products are sold by Scully, and Scully makes no warranty of suitability for any particular purpose in respect to the products sold.

Scully products or parts thereof assumed to be defective by the purchaser within the stipulated warranty period should be returned to the seller, local distributor, or directly to Scully for evaluation and service. Whenever direct factory evaluation, service, or replacement is necessary, the customer must first, by either email or phone, obtain a Returned Material Authorization Number (RMA) from Scully Company directly. No material may be returned without an RMA number assigned to it or without proper factory authorization.

Any returns must be returned freight prepaid to:

Scully Signal Company, 70 Industrial Way
Wilmington, MA 01887 U.S.A., Attention: Service Dept.

Returned warranty items will be repaired or replaced at the discretion of the Scully Service Department according to Scully Product Warranty Policy and the Scully Returned Materials Procedure. Any Scully items under the Scully Warranty Policy that are deemed not repairable by the Scully Service Department will be replaced at no charge or a credit issued for that item subject to the customer's request.

Maintenance

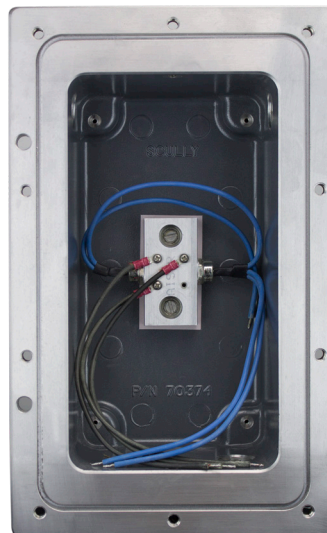
7.4 Troubleshooting Guide

If the front panel Dynacheck LED is not flashing, with other LEDs illuminated, it likely there is a problem with the module assembly power. The diode pack (heat sink assembly) in the rear of the Intellitrol2 housing should be verified before replacing/installing any new or refurbished module.

7.4.1 Checking the Diode Pack

Using a multimeter on the diode setting, measure from the tip of each blue wire to the screws where the black wires are mounted. Correct readings should be ~ .50 - .60 (diode scale) with the red lead on the screws and the black lead on the blue wire. With the leads reversed it should read as an open.

If the reading indicates a short, the diodes in the component are faulty and the pack itself will require replacement. This must be replaced before installing a new or refurbished module. Failure to replace the diode pack WILL result in damage to any module installed.



The following table summarizes errors indicated via the front panel and their most likely causes. Problems covered are the:

- Intellitrol2 Self Check failure
- Unit's plug and cable assembly(s)
- Vehicle trying to get a permissive signal to load at the rack.

This chart and the troubleshooting guide should be consulted prior to requesting technical service help. If after consulting the chart you are unable to resolve the problem contact Scully Technical Services at 1-800 Scully and be prepared to communicate the status of the indicators on the front panel.



WARNING: Certain checks may require access to the inside of the control unit to verify or change configuration jumpers. Any activity requiring the opening of the unit should only be performed by qualified personnel. The area must be secured and vapor free before opening the enclosure to avoid explosion.

AVERTISSEMENT: Certains contrôles peuvent exiger l'accès à l'intérieur de l'unité de contrôle pour vérifier ou modifier les cavaliers de configuration. Toute activité nécessitant l'ouverture de l'appareil ne doit être effectuée par du personnel qualifié. La zone doit être fixée et la vapeur libre avant d'ouvrir le boîtier pour éviter l'explosion.

7.4.2 Table-2: Front Panel Display Trouble Shooting Chart

Table-2a: Front Panel Display Trouble Shooting Chart


Red Non Permit Bar	Green Permit Bar	Compartment LEDs	Optic Out	Optic In	Ground Error	Ground	Service	Comm. Terminal	Comm. Vehicle	Vehicle Id			Dynacheck	<p>OPERATING CONDITION</p> <p><i>Assumes ground proving and VIP enabled, lights for disabled options will always be off</i></p>
										Authorized	Unauthorized	Standby		
On													*	Rack not permitting
On	Off	Off			Off	Off						On	*	Rack not permitting; No vehicle connected or connected without ground proving, faulty or missing T.I.M. or open dead man
On	Off	On											*	Vehicle connected, and indicated sensor is wet or thermistor sensor still warming
On	Off	**											*	No vehicle connected and an I/O pin (1-8) of the Scully connector shorted or 2-wire sensor shorted
On	Off	#											*	2-wire sensor open
@	Off												*	Vehicle connected and bypassing faulty sensor
@	Off						@						*	Shorted output relay
Off	On												*	Vehicle connected and rack permitting, all sensors dry
Off	@												*	If slow blink, bypassing Ground Proving and/or VIP. If fast blink, the Active Deadman is nearing the end of its close time (see 6.4.1).
			@										*	Vehicle connected; main processor pulsing 5-wire optic sensors
			@	Off									*	Main processor not receiving 5-wire optic pulses back from 5-wire sensors
			@	@									*	Vehicle connected, main processor pulsing 5-wire optic sensors and optic return being sensed
					On	Off							*	Vehicle connected and ground proving fault
					Off	On							*	Vehicle connected and ground proving successful.
		@			*	Off							*	Vehicle connected, Ground proving bypassed
							Off						*	No system error detected
	@	Flashing												
	*	Flashing at Dynacheck rate (once per second)												
	#	Flashing slow (once every two seconds)												
	**	Flashing fast (twice per second)												

Maintenance

Table-2b: Front Panel Display Trouble Shooting Chart

Red Non Permit Bar	Green Permit Bar	Compartment LEDs	Optic Out	Optic In	Grounds	Service	Comm. Terminal	Comm. Vehicle	Vehicle Id			Dynacheck	<p>OPERATING CONDITION</p> <p><i>Assumes ground proving and VIP enabled, lights for disabled options will always be off</i></p>
									Authorized	Unauthorized	Standby		
		** **				@						*	System error detected. Compartment LEDs 7 & 8 flashing indicates EEPROM or program memory error.
							On					*	Terminal communications line error
							Off					*	Intellitrol2 not communicating with terminal
							*					*	Intellitrol2 communicating with terminal
							On					*	Vehicle communications error
							Off					*	Vehicle not connected/not communicating
							*					*	Intellitrol2 communicating with the vehicle
								On	Off	Off		*	Vehicle connected, T.I.M. good, and authorized
								*	Off	Off		*	Vehicle connected, VIP bypassed
								Off	On	Off		*	Vehicle connected, T.I.M. good but not unauthorized, i.e. ID not in VIP list
								Off	Off	On		*	Vehicle not connected, or unable to read T.I.M.s
								Off	*	Off		*	With vehicle connected, unable to see T.I.M.s
												*	Intellitrol 2 with VIP operational
												*	Intellitrol 2 without VIP operational
											Off		Unrecoverable system error occurred
Off	Off	Off	Off	Off	Off	Off	Off	Off	Off	Off	Off	Off	No Power; front panel bad/not connected
													All other displays = bad front panel or unit
@	Flashing												
*	Flashing at Dynacheck rate (once per second)												
#	Flashing slow (once every two seconds)												
**	Flashing fast (twice per second)												
** *	Compartments 7 & 8 Flashing												

7.5 Installing Replacement Parts


 **Warning:** Opening the Intellitrol2 exposes Non-Intrinsically safe circuits to the atmosphere. Always assure the location is secured and is non-hazardous before opening an explosion proof housing. *l'ouverture du Intellitrol2 expose Non-Intrinsically circuits de sécurité dans l'atmosphère. Toujours assurer l'emplacement est sécurisé et est non dangereux avant d'ouvrir une explosion boîtier étanche*

The Intellitrol2 contains only three field replaceable modules. Order a replacement with the correct part number corresponding to the options purchased.

- Control Module
- Front Panel display
- Heat Sink Assembly

7.5.1 Control Module Replacement Procedure

- Disconnect the unit from power
- Unbolt and open the Intellitrol2 door
- Unplug all connectors, noting orientation of J1 ribbon to front panel
- Remove all ground wires from the TB1 terminal block
- Loosen the four captive screws in the corners of the module and remove the wires on the bottom of the module connecting to the heat sink assembly.
- Re-assemble in reverse direction

 **Warning:** The blue and black wires from the IS Barrier Heat sink assembly are an integral part to safety and **MUST** all be reconnected to assure continued Intrinsic Safety! *les fils bleu et noir de la barrière est assemblage du dissipateur de chaleur sont une partie intégrante de la sécurité et doivent toutes être reconnecté à garantir la poursuite sécurité intrinsèque !*

7.5.2 Front Panel Display Module Replacement

- Remove power from the unit
- Refer to drawing 63103 in section 7.5.1 for the next steps
 - Remove the 6 screws from the Lens assembly
 - Remove the panel assembly (items 6, 7 and 11) being careful not to lose the nylon washers between the backing plate and cover (washers not shown in drawing)
 - Disconnect the connector at the back of the panel assembly noting the orientation
 - Re-assemble in reverse direction

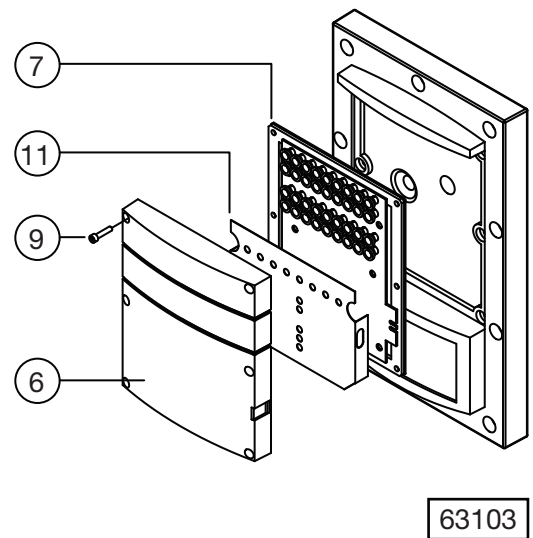
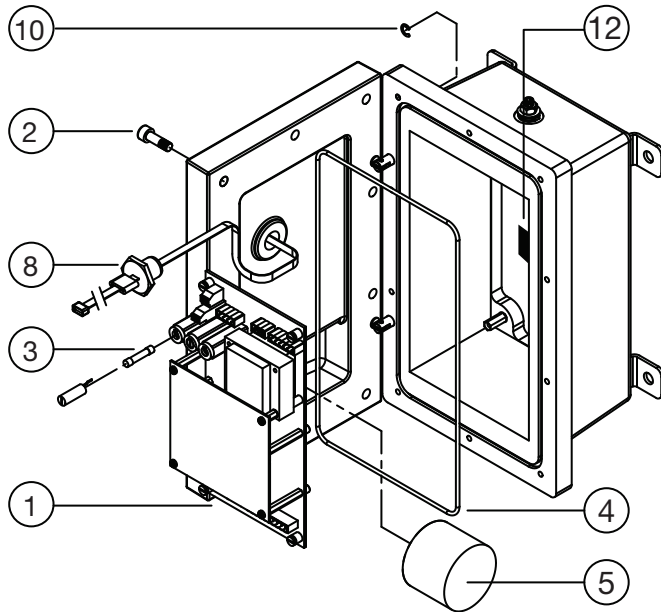
Maintenance

7.6 Parts Available

The following lists contain the common spare field replaceable parts available for the Intellitrol2 control unit and accessory items. Please consult the factory for any parts not mentioned below.

7.6.1 Table-3: List of Replacement Parts

Item	Description	Part Number	Qty.
1	Module Assembly, 2-OG 240V	09551	1
	Module Assembly, 2-OGV 120V	09552	
	Module Assembly, 2-OGV 240V	09577	
	Module Assembly, 2-OG 120V	09576	
2	Cover Bolt, M8 x 1.25 x 25mm	50005	10
3	Contact Fuse (F5, F8), 5A, Hi-interrupt	26372	6
4	Cover O-ring (gasket)	31340	1
5	Corrosion Inhibitor	40268	1
6	Lens Assembly (with 6 mounting screws)	09181 (ATEX) 08980 (FM)	1
7	Intellitrol2 Display Module (with backing plate)	09553	1
8	Display Cable Feed-through	08982	1
9	Lens Mounting Screw, 8-32 x 3/4	50080	6
10	Retaining Ring, Cover Hinge	54039	2
11	Text Mask (English), Overfill and Ground	38052*	1
	Text Mask (English), Overfill, Ground and Vehicle ID	38053*	
12	Heat Sink Assembly	09481	1



63103

*To order lens mask in text other than English, add:

- S for Spanish
- F for French
- G for German
- I for Italian
- D for Danish

Example: 38052S = Lens Mask, Spanish Text, Overfill & Grounding

7.6.2 Table-4: List of Accessories

Part Number	Description
08939	Bypass Key Authorizer
08863	Deadman Control Switch Assembly
08951	Intelliview® 2 Terminal Software
09001	RS-232 to RS-485 Converter Kit (for communications)
08958	SC-8OB Sculcon Junction Box with 8B Style Black Poly Plug and 6 meter (20 ft) Blue Straight Cable (for 2-wire or 5-wire sensors - 4-bayonet pins - 10 contact pins)
08959	SC-8B Sculcon Junction Box with 8B Style Green Poly Plug and 6 meter (20 ft) Blue Straight Cable (for 2-wire or 5-wire sensors - 4 bayonet pins - 10 contact pins)
08729	SC-8A Sculcon Junction Box with 8A Style Green Poly Plug and 9 meter (30 ft) Orange Coiled Cable (for 2-wire sensors - 2 bayonet pins - 10 contact pins)
08156	SC-6A Sculcon Junction Box with 6A Style Green Poly Plug and 9 meter (30 ft) Orange Coiled Cable (for 2-wire sensors - 2 bayonet pins - 8 contact pins)
08159	SC-6W Sculcon Junction Box with 6W Style Blue Poly Plug and 9 meter (30 ft) Blue Coiled Cable (for 5-wire sensors - 3 bayonet pins - 6 contact pins)

Technical Service Hot-Line / Notes

Technical Service Hot-Line

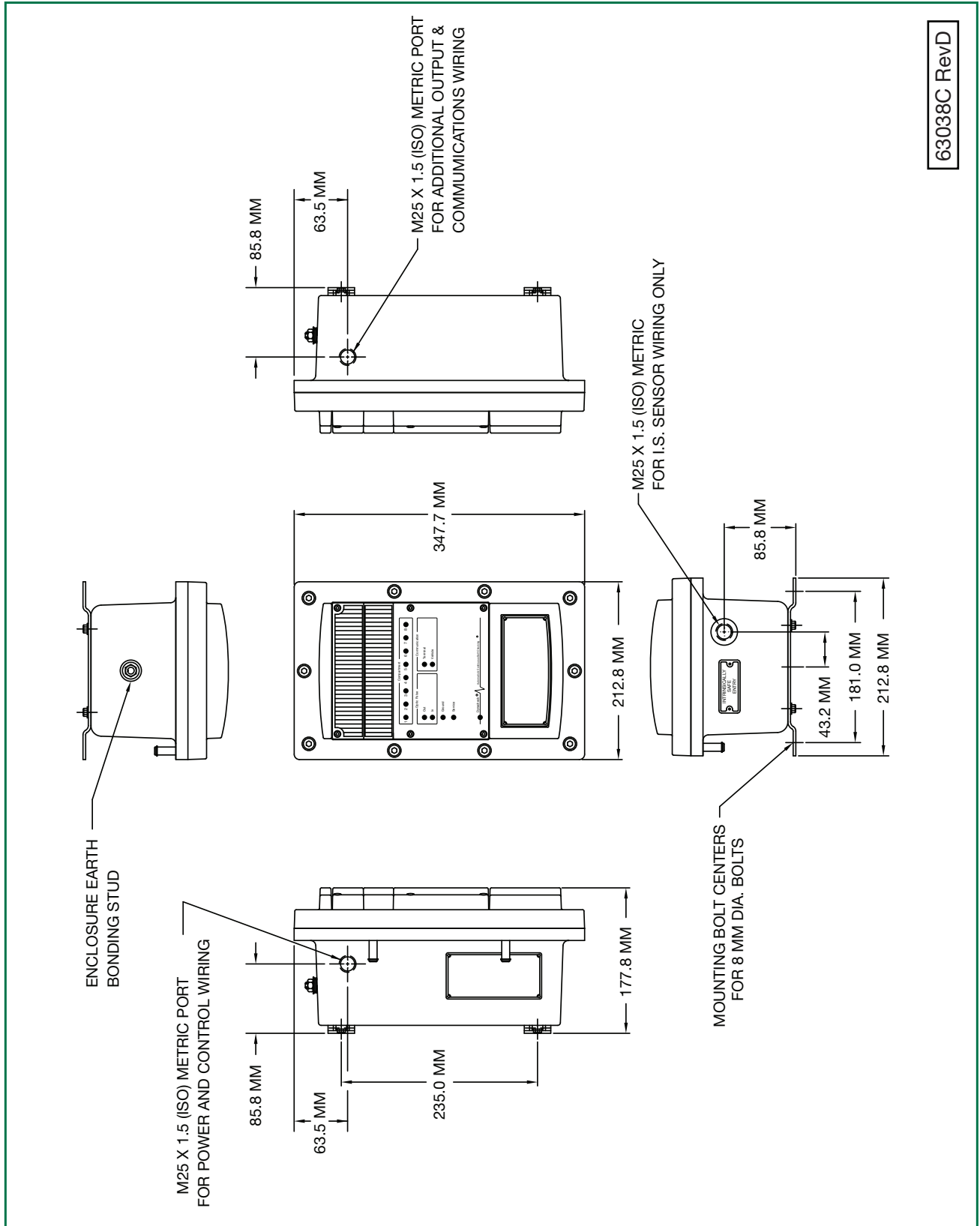
Scully's Technical Service Department can be reached at the corporate headquarters in Wilmington, MA U.S.A. by telephone at (617) 692-8602; by FAX at (617) 692-8620; and by email at Techservice@scully.com. If calling from within the United States, our toll free Technical Service Hot-Line Number is (800) 272-8559.

Our technical service department staff is available from 8 AM to 5 PM Eastern Standard Time to answer any questions which may arise regarding the installation, operation or service of the Scully Intellitrol2 and accessories.

Notes

Diagram Appendix

9.1 Dwg. No. 63038C – Intellitrol Enclosure Outline, Model Series ICC



63038C RevD

9.2 Dwg. No. 63038 – Intellitrol Enclosure Outline, Model Series IC

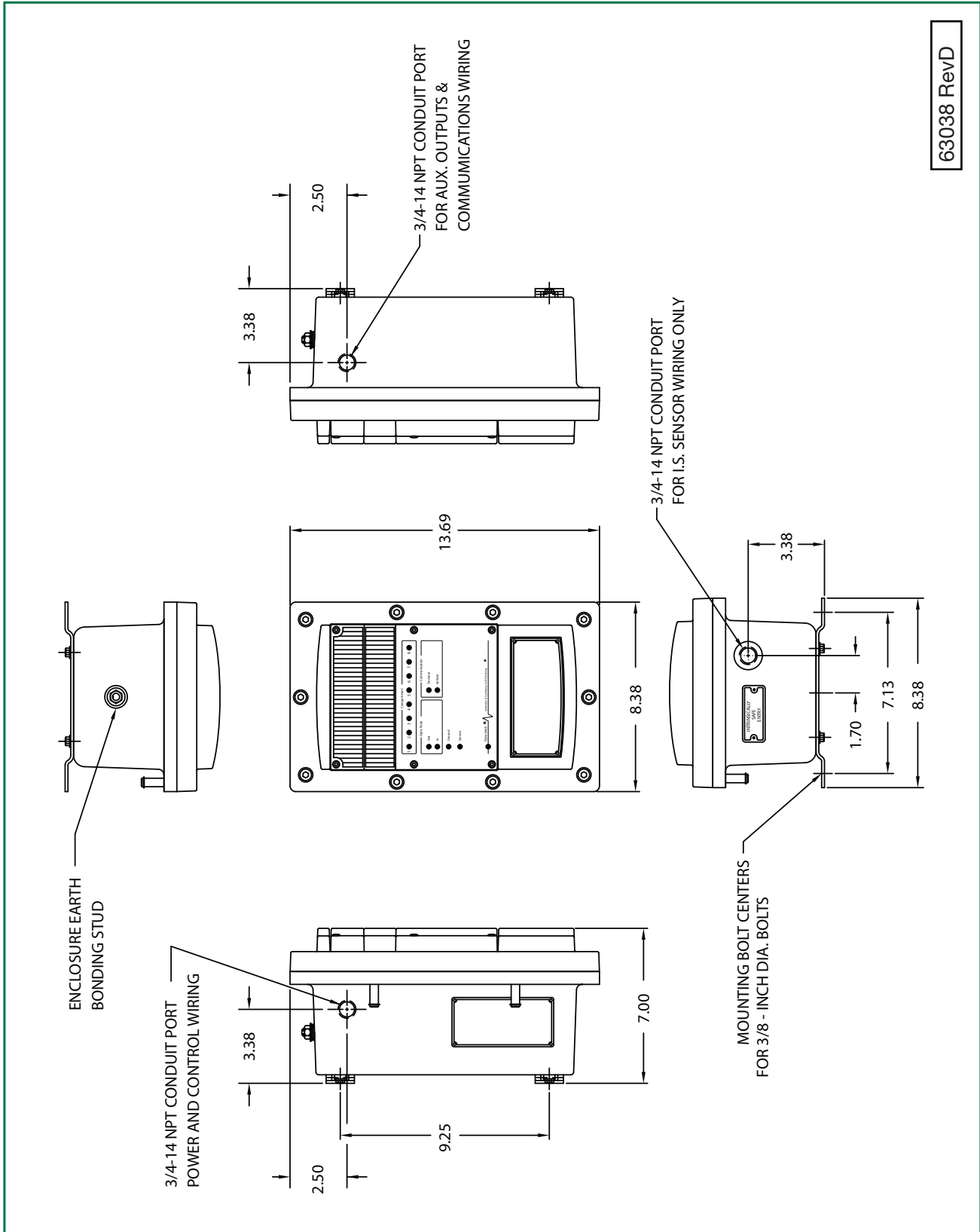
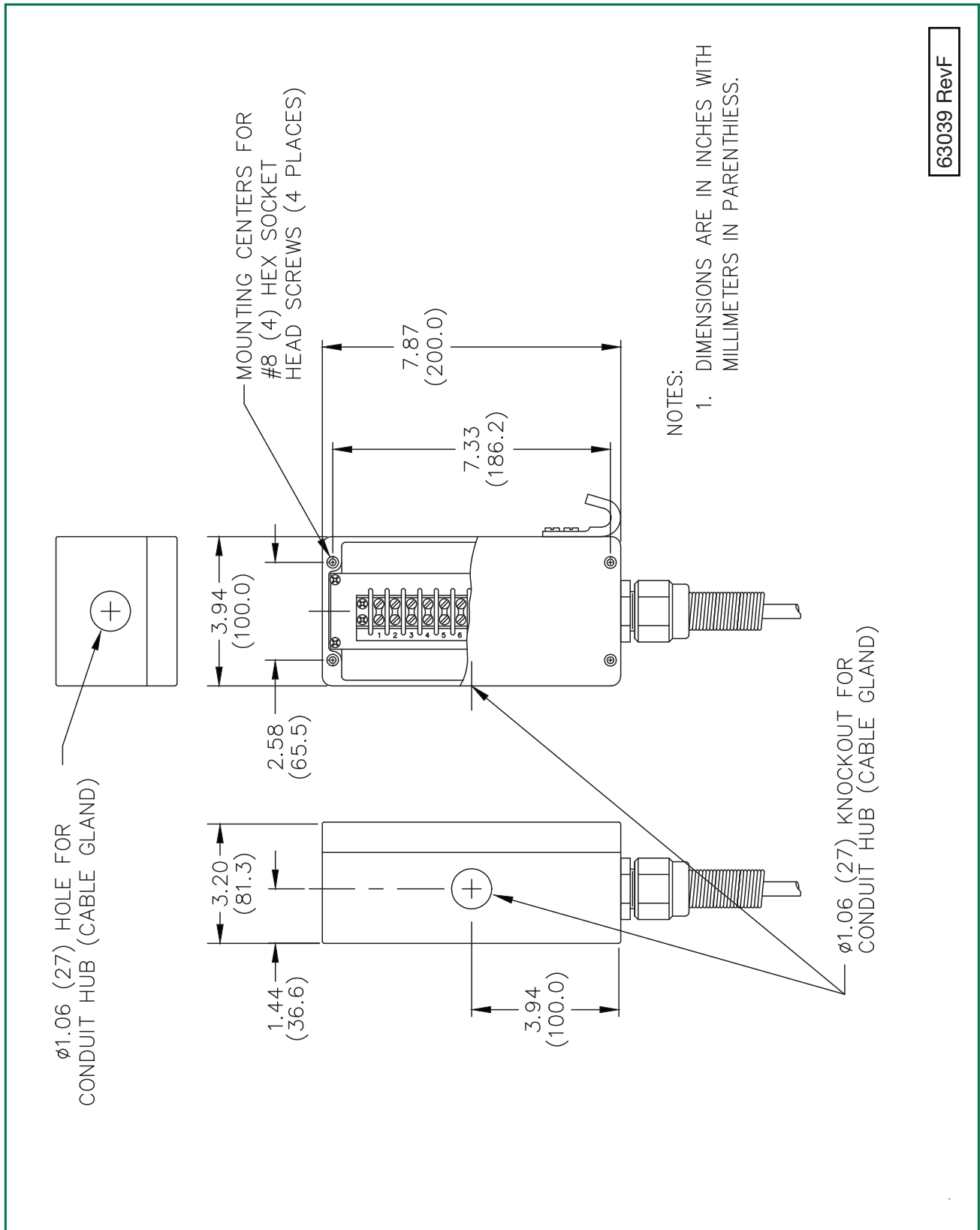


Diagram Appendix

9.3 Dwg. No. 63039 – Sculcon Plug and Cable Assembly Outline



63039 RevF

9.4 Dwg. No. 61337C – Mech. Installation, Intellitrol Model Series ICC

ADDITIONAL OUTPUT CONTROL & COMMUNICATIONS WIRING

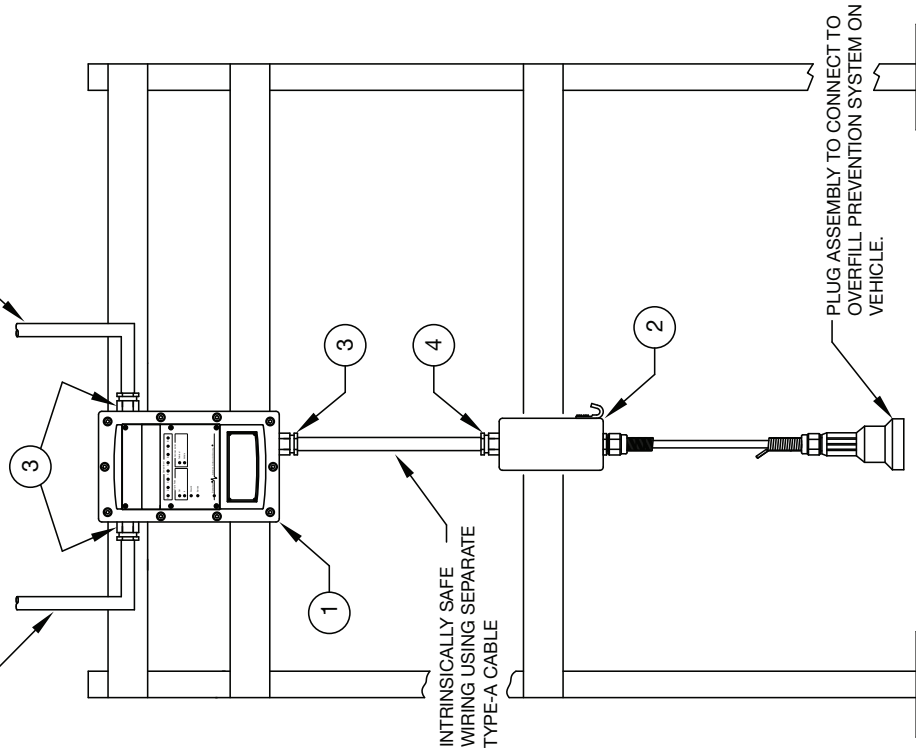
MAINS POWER AND OUTPUT CONTROL WIRING

EQUIPMENT SCHEDULE (TYPICAL)

1. INTELLITROL CONTROL UNIT.
2. SCULCON PLUG AND CABLE UNIT.
3. FLAMEPROOF Exd CABLE GLAND FITTING.
4. INDUSTRIAL CABLE GLAND FITTING.

INSTALLATION NOTES

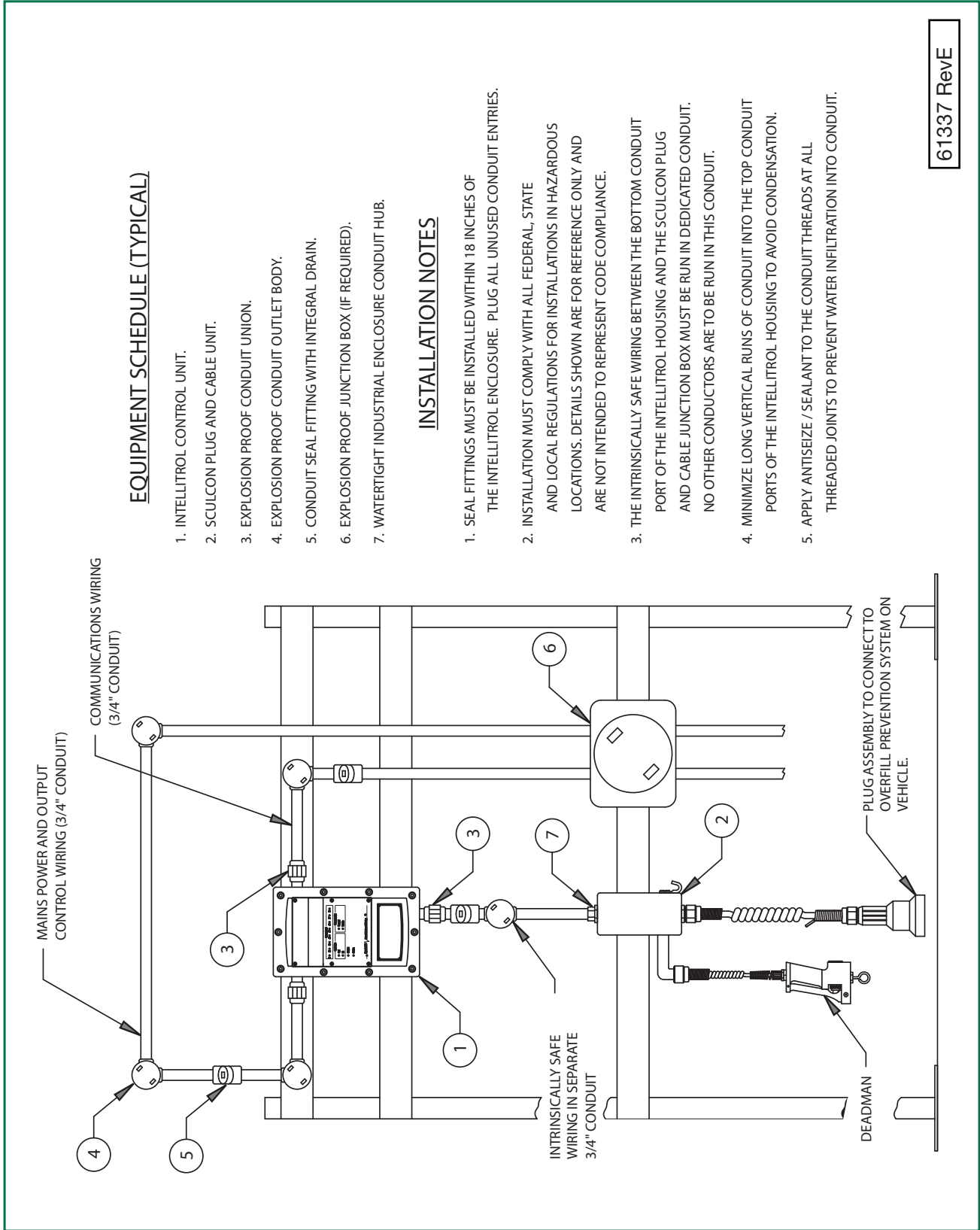
1. INSTALLATION MUST COMPLY WITH NATIONAL AND LOCAL REGULATIONS FOR INSTALLATIONS IN HAZARDOUS LOCATIONS. DETAILS SHOWN ARE FOR REFERENCE ONLY AND ARE NOT INTENDED TO REPRESENT CODE COMPLIANCE.
2. THE INTRINSICALLY SAFE WIRING BETWEEN THE BOTTOM PORT OF THE INTELLITROL HOUSING AND THE SCULCON PLUG AND CABLE JUNCTION BOX MUST BE RUN USING DEDICATED TYPE-A CABLE OR IN A CONDUIT. NO OTHER SIGNALS ARE TO BE RUN IN THIS CABLE OR CONDUIT.
3. MINIMIZE LONG VERTICAL RUNS OF CABLE INTO THE TOP PORTS OF THE INTELLITROL HOUSING TO AVOID CONDENSATION CHANNELING.
4. USE FIBER SEALING WASHERS BETWEEN THE CABLE GLAND FITTINGS AND THE INTELLITROL HOUSING AT ALL CABLE PORT ENTRIES.
5. ANY UNUSED HOLES IN THE FLAMEPROOF ENCLOSURE MUST BE PLUGGED USING A CERTIFIED FLAMEPROOF STOPPER PLUG.



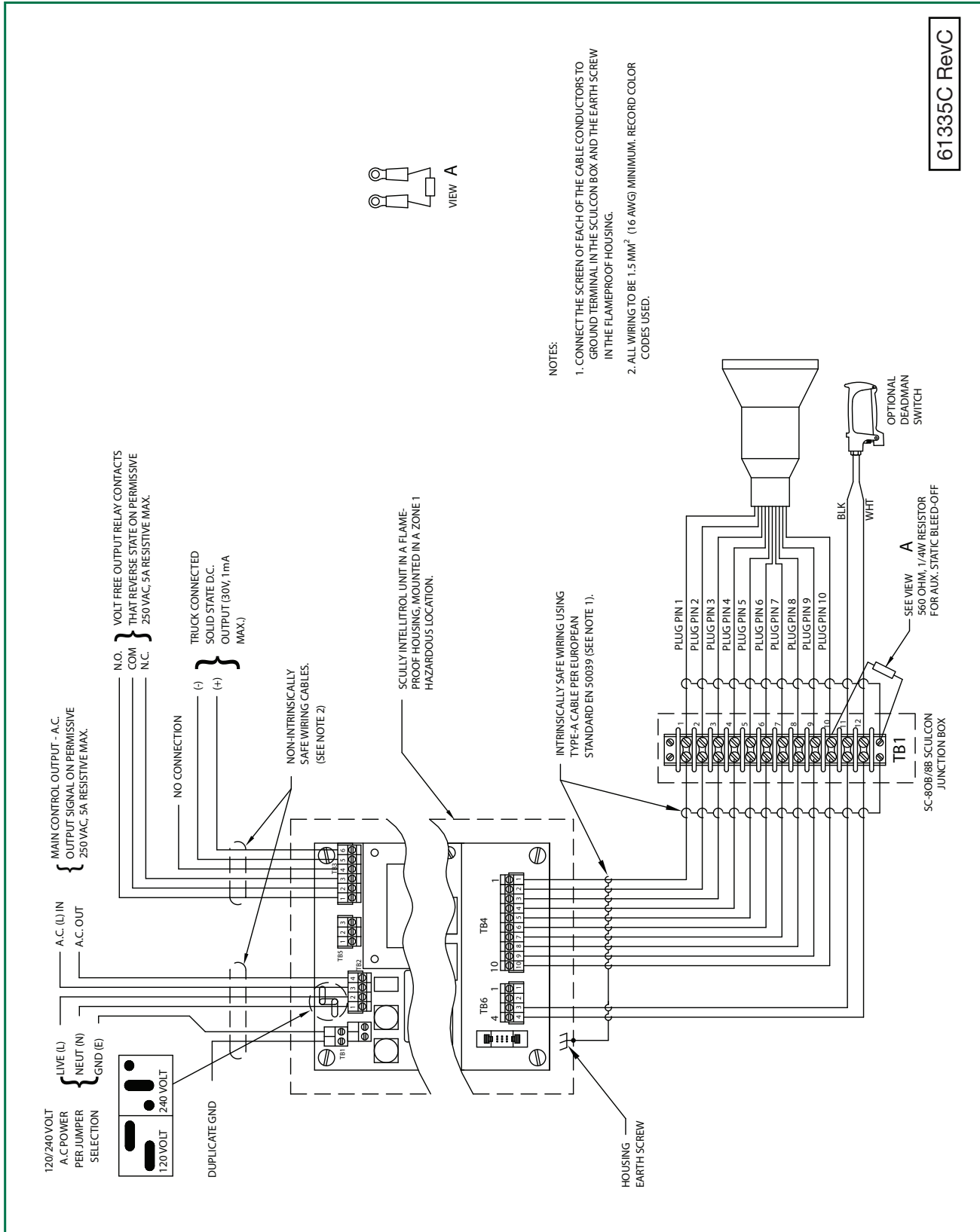
61337C RevD

Diagram Appendix

9.5 Dwg. No. 61337, Mech. Installation, Intellitrol Model Series IC



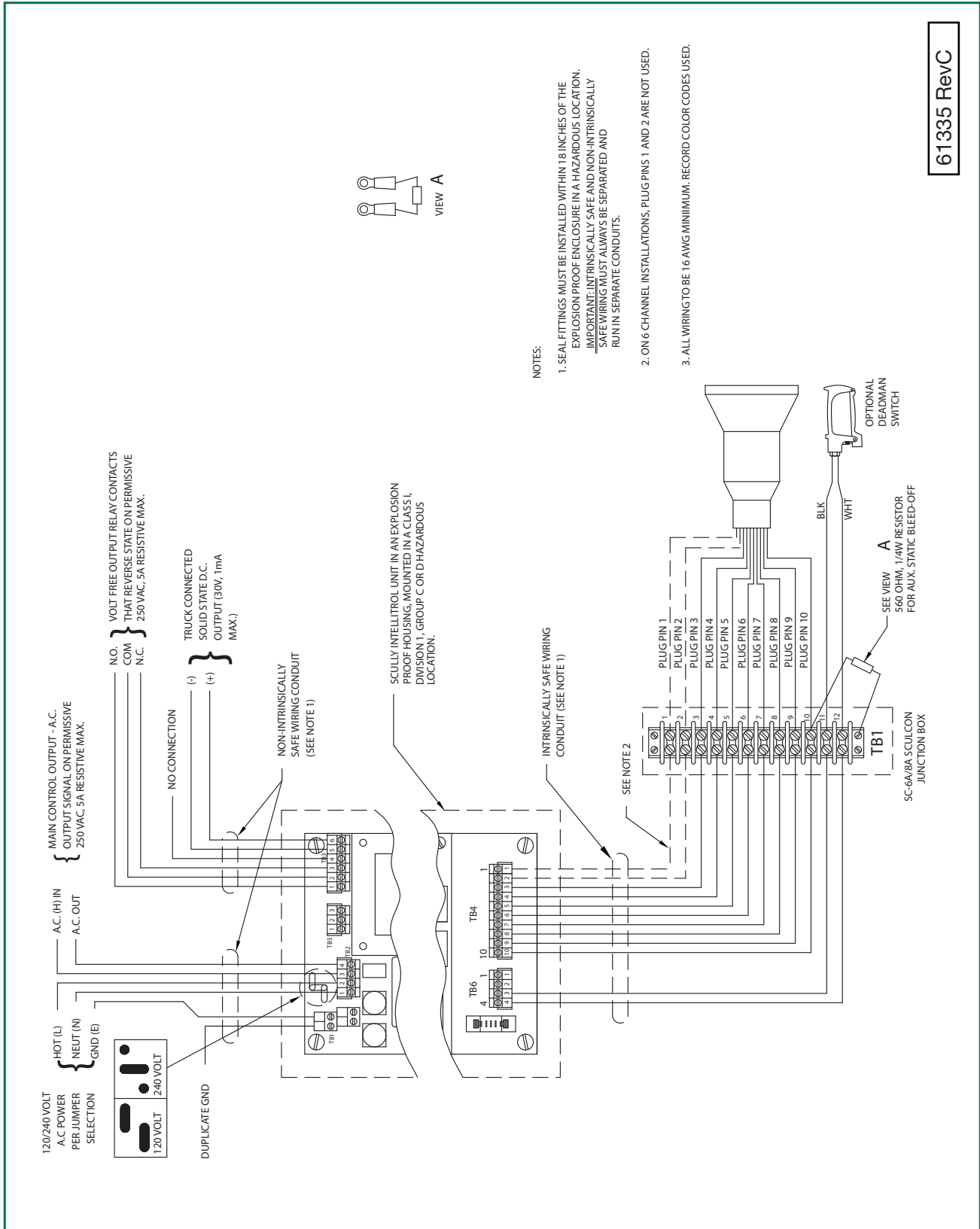
9.6 Dwg. No. 61335C – (2-Wire, Optic or Therm.) Sculcon Field Wiring Diagram



61335C RevC

Diagram Appendix

9.7 Dwg. No. 61335 – (2-Wire, Optic or Therm.) Sculcon Field Wiring Diagram with Deadman.



61335 RevC

9.8 Dwg. No. 61394C – Multiple Sculcon (2-wire and 5-wire) Field Wiring Diagram

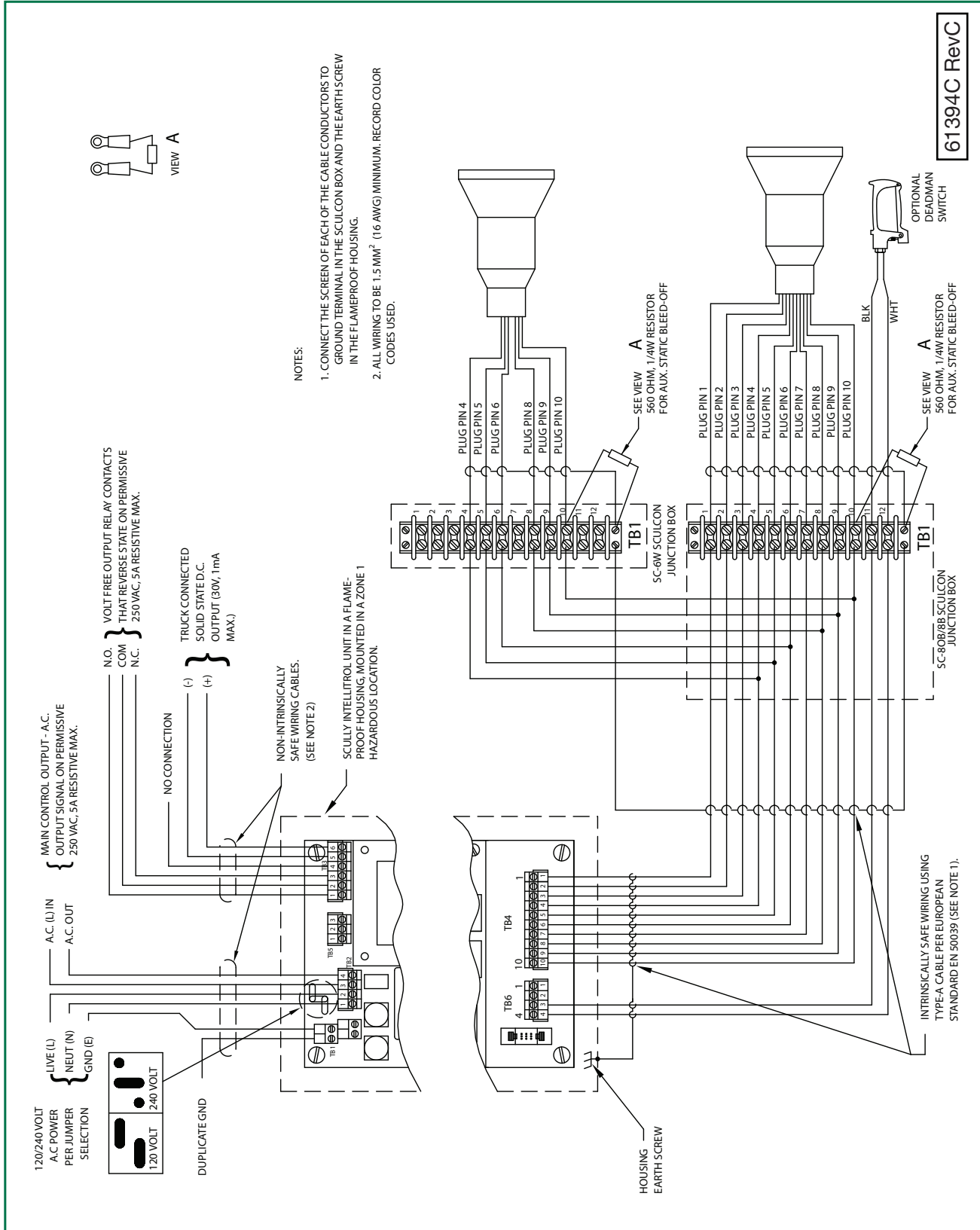
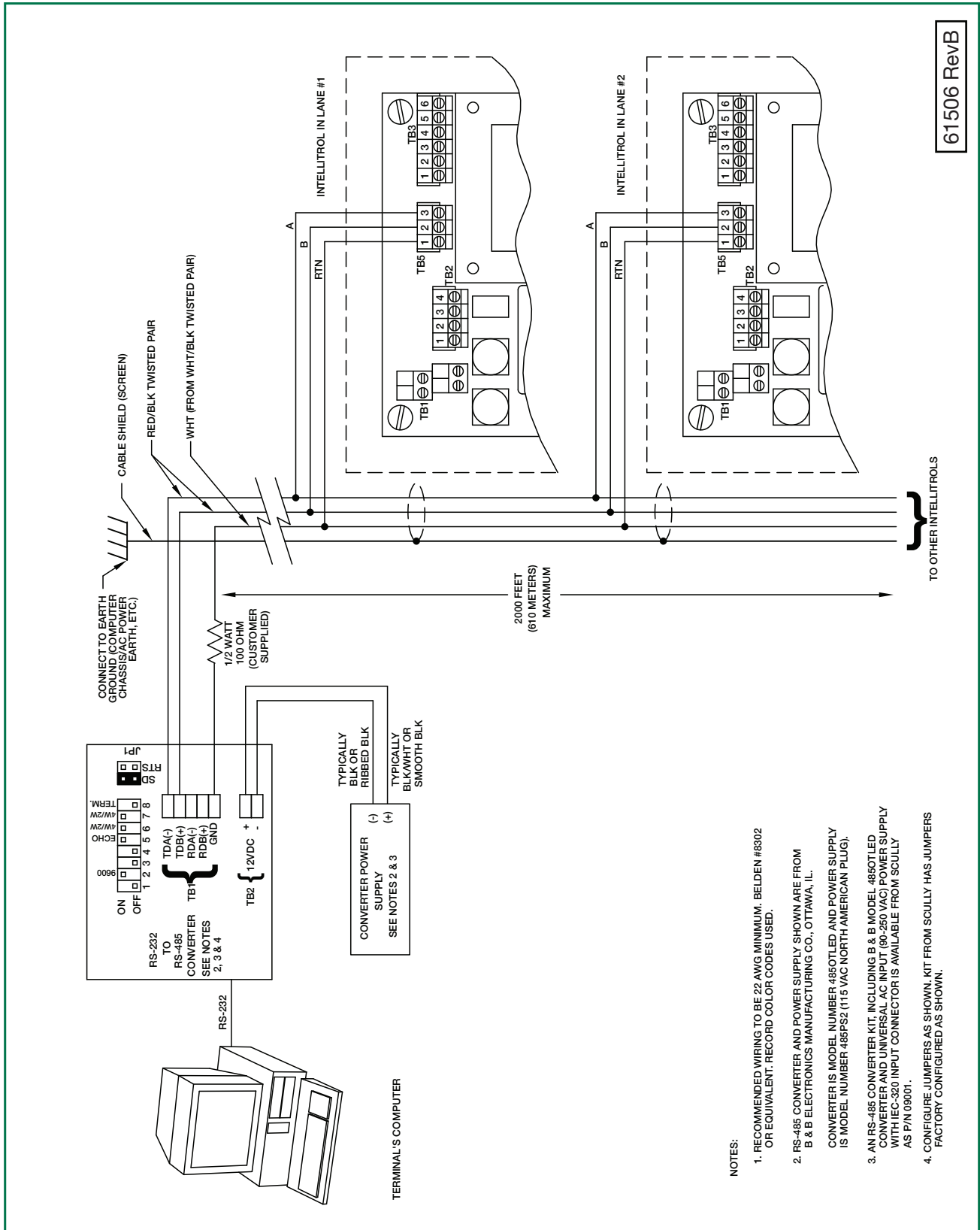


Diagram Appendix

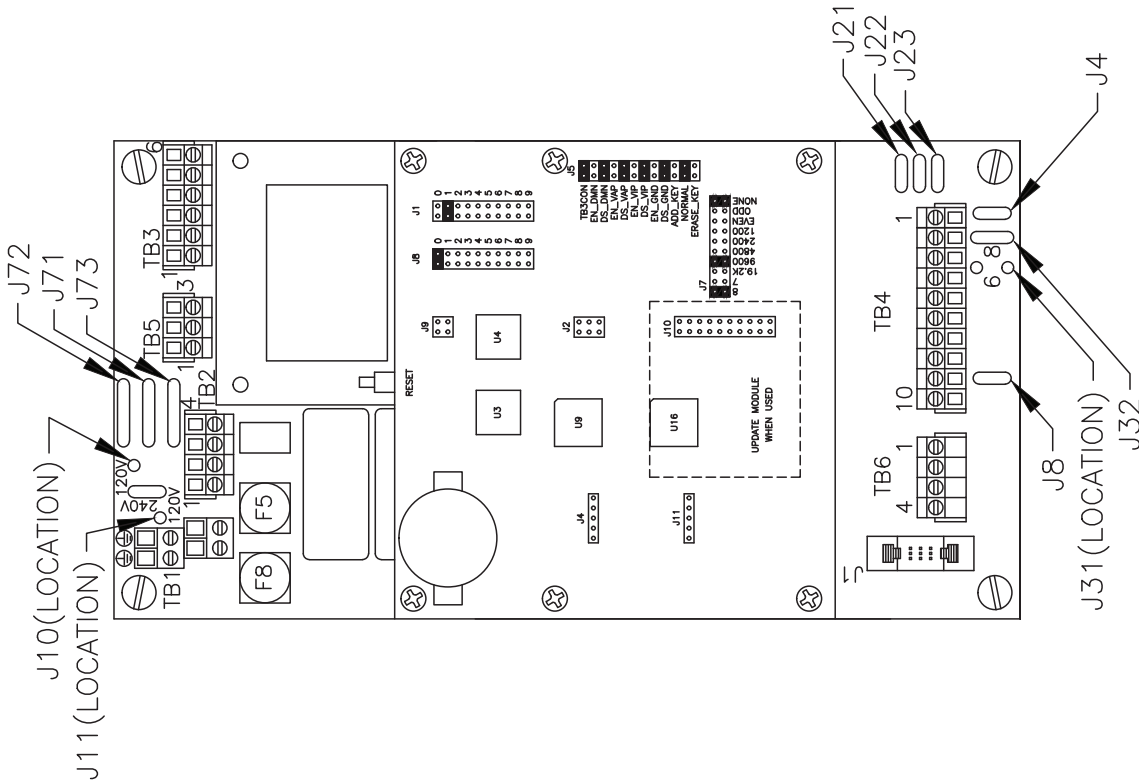
9.9 Dwg. No. 61506 - Multi-drop Communications Field Wiring Diagram



9.10 Dwg. No. 63040SIL – SIL Intellitrol Control Module Outline

JUMPER/FUSE FUNCTIONAL DETAILS:

- J10/J11 – AC INPUT POWER SELECTOR JUMPERS. FACTORY SET FOR 240 VAC OPERATION. FOR 120 VAC OPERATION, REMOVE VERTICAL JUMPER AND REINSTALL HORIZONTALLY INTO J10 LOCATION. INSTALL SPARE RED JUMPER HORIZONTALLY INTO J11 LOCATION.
- J71, J72 & J73 – EARTH (GROUND) ISOLATION JUMPERS. THESE JUMPERS ARE ALWAYS INSTALLED, DO NOT REMOVE.
- FUSES:
 - F-8, MAIN OUTPUT RELAY (5A, 1/4" X 1-1/4", CERAMIC HI-INTERRUPT)
 - F-5, FORM-C AUX. OUTPUT (5A, 1/4" X 1-1/4" CERAMIC HI-INTERRUPT)
- J8 – GROUND VERIFICATION JUMPER:
 - LEAVE IN PLACE IF ALL VEHICLES ARE WIRED WITH SOCKET PIN NOS. 9 & 10 CONNECTED TO THE VEHICLE CHASSIS – (FACTORY SETTING). REMOVE IF ALL VEHICLES EQUIPPED WITH SCULLY GROUND BOLTS.
- J31/J32 – 6 OR 8 SENSOR CHANNELS OPERATING MODE:
 - LOCATION J32 – FOR 8 SENSOR CHANNEL OPERATION (FACTORY SETTING)
 - LOCATION J31 – FOR 6 SENSOR CHANNELS OPERATION (MOVE BLUE JUMPER FROM J32 LOCATION)
- J4 – 3.5/3.8 VOLTS SENSOR THRESHOLD JUMPER:
 - LEAVE IN PLACE FOR 3.8 VOLT SENSOR THRESHOLD OPERATION (TYPICAL FOR AUSTRALIA, EUROPE, HONG KONG & NEW ZEALAND) – (FACTORY SETTING)
 - REMOVE FOR 3.5 VOLT SENSOR THRESHOLD OPERATION (TYPICAL FOR NORTH AMERICA & SOUTH AMERICA)
- J21, J22 & J23 – MAXIMUM SENSOR OUTPUT VOLTAGE JUMPER:
 - LEAVE IN PLACE FOR BASEEFA/GENELEC APPROVED MODELS – (FACTORY SETTING).



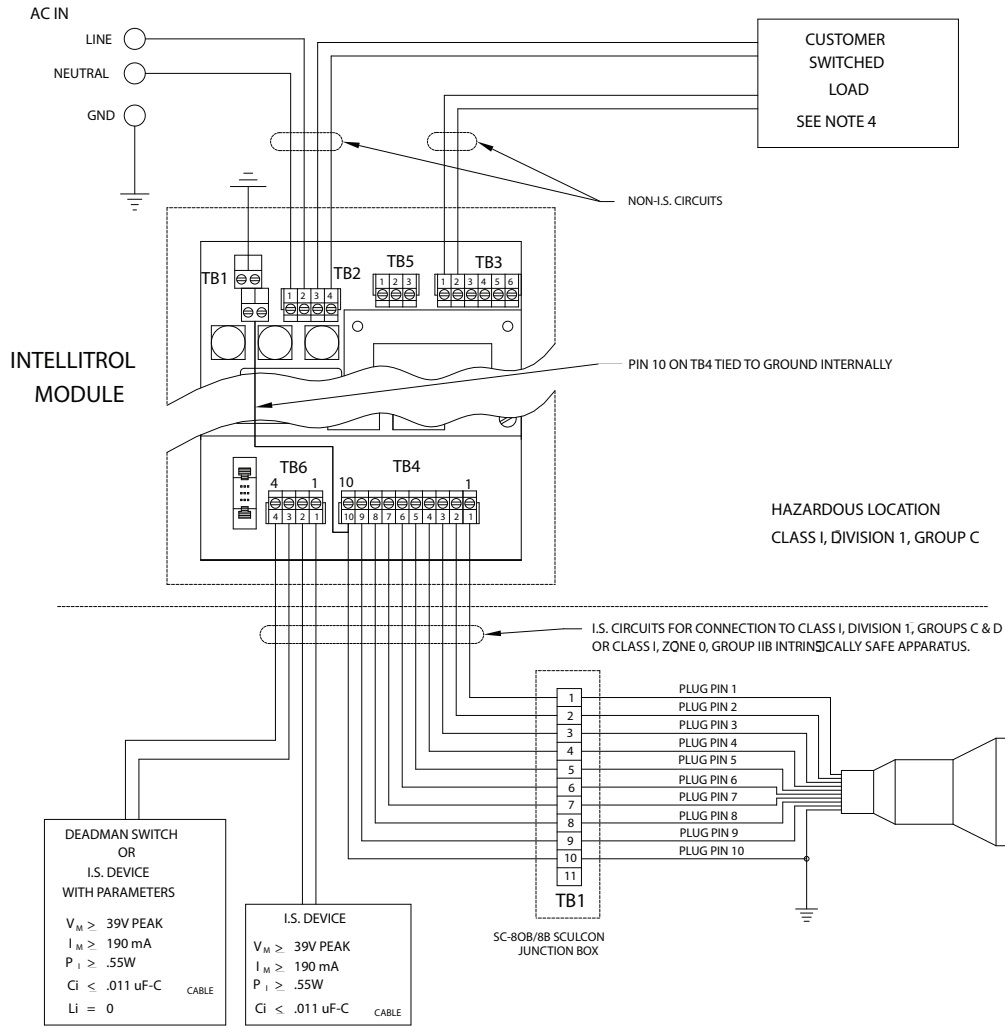
63040SIL RevB

Diagram Appendix

9.11 Dwg. No. 61659 Pg.-1 – Intellitrol with Entity Parameters

NOTES:

1. NO RELEASE OF REVISION CHANGE WITHOUT PRIOR FM APPROVAL.
2. SEAL FITTINGS MUST BE INSTALLED WITHIN 18 INCHES OF AN EXPLOSION PROOF ENCLOSURE IN A HAZARDOUS LOCATION.
3. THE IMPORTANCE OF MAINTAINING ABSOLUTE SEPARATION BETWEEN INTRINSICALLY SAFE AND NON-INTRINSICALLY SAFE WIRING CANNOT BE OVER EMPHASIZED!
4. CONTROL EQUIPMENT CONNECTED TO ASSOCIATED APPARATUS MUST NOT USE OR GENERATE MORE THAN 250 VRMS OR VDC.
5. THE ENTITY CONCEPT ALLOWS INTERCONNECTION OF INTRINSICALLY SAFE APPARATUS WITH ASSOCIATED APPARATUS WHEN THE FOLLOWING IS TRUE.
 V_{max} or $I_i > V_{oc,Vt}$ or U_o
 I_{max} or $I_i > I_{sc,It}$ or I_o .
 P_{max} or $P_i > P_o$ ___
 $C_a > C_i + C$ CABLE
 $L_a > L_i + L$ CABLE
6. RESISTANCE BETWEEN INTRINSICALLY SAFE GROUND AND EARTH GROUND MUST BE LESS THAN 1.0 OHM.
7. INSTALLATION SHOULD BE IN ACCORDANCE WITH ANSI/ISA RP12.06.01 "INSTALLATION OF INTRINSICALLY SAFE SYSTEMS FOR HAZARDOUS (CLASSIFIED) LOCATIONS" AND THE NATIONAL ELECTRICAL CODE. (ANSI/NFPA 70).
8. I.S. DEVICE MAY CONNECT TO MULTIPLE OUTPUTS PINS 1-8 PROVIDED ENTITY PARAMETERS COMPLY TO CHARTS.



61659 RevB

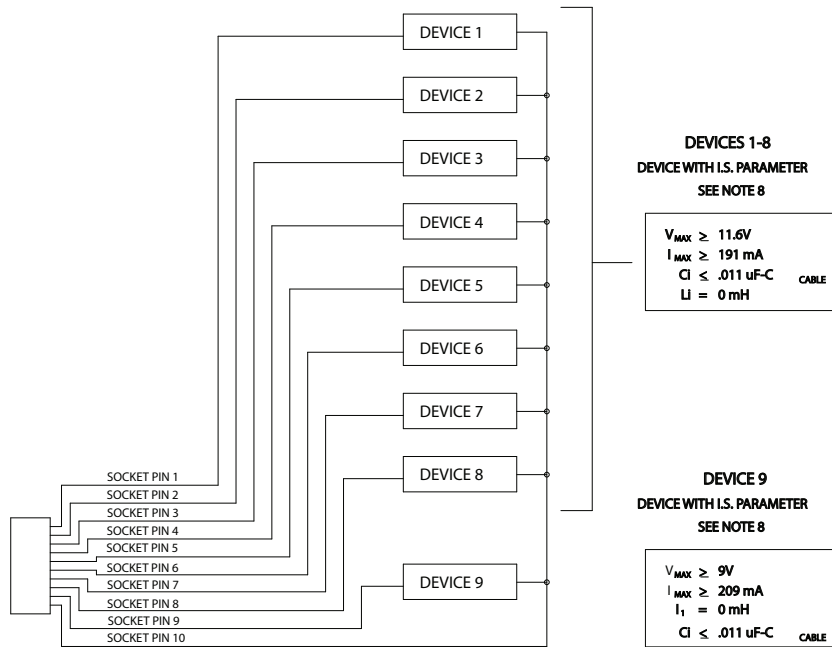
9.12 Dwg. No. 61659 Pg.-2 – Intellitrol with Entity Parameters

INTELLITROL I.S. OUTPUT ENTITY PARAMETERS

TB4-X W.R.T. TB4, PIN 10	U_o	I_o	P_o	C_i	L_i
1	11.6V	191mA	0.55W	0.011uF	0
2	11.6V	191mA	0.55W	0.011uF	0
3	11.6V	191mA	0.55W	0.011uF	0
4	11.6V	191mA	0.55W	0.011uF	0
5	11.6V	191mA	0.55W	0.011uF	0
6	11.6V	191mA	0.55W	0.011uF	0
7	11.6V	191mA	0.55W	0.011uF	0
8	11.6V	191mA	0.55W	0.011uF	0
9	9V	209mA	0.61W	0	0

AUXILIARY I.S. INPUTS & DEADMAN SWITCH INPUT

TB6-X TB6, PIN 4	U_o	I_o	P_o	C_i	L_i
1	39V PEAK	190mA	0.55W	0.011uF	0
2	39V PEAK	190mA	0.55W	0.011uF	0
3	39V PEAK	12mA	0.04W	0.011uF	0



61659 RevB

Diagram Appendix

9.13 SIL Specific Information

Caution: System is only operating in SIL mode when used with SIL Sensors like Scully SP-FU, SP-TO or Dynaprobos.

$$PFD_{avg} = 9.3 \times 10^{-4} \quad SFF = \frac{\lambda_S + \lambda_{DD}}{\lambda} = \frac{\lambda - \lambda_{DU}}{\lambda}$$

	Intellitrol2 w/o sensors						Intellitrol2 w/ single 5-wire sensor (SP-FU)		Intellitrol2 w/ twelve 5-wire sensors (SP-FU)		Intellitrol2 w/ 2-wire sensors (SP-TO)		Intellitrol2 w/ Thermistor sensors (Dynaprobos)	
	Power Supply	Extension Brd.	Main Brd.	Processor 1	Processor 2	Total *	Single Channel	Total Intellitrol 2 + Sensor	Single Channel	Total Intellitrol 2 + Sensors	Single Channel **	Total Intellitrol 2 + Sensors	Single Channel **	Total Intellitrol 2 + Sensors
$\lambda_{[FIT]}$	42.680	68.408	1967.489	265.331	397.996	2078.578	117	2195.578	1404	3482.578	139.6	2218.178	55.1	2133.678
$\lambda_S [FIT]$	37.127	54.263	1198.590	207.043	310.565	1289.980	116	1405.980	1392	2681.980	137.7	1427.68	48.3	1338.28
$\lambda_D [FIT]$	5.553	14.145	768.899	58.288	87.432	788.597	1	789.597	12	800.597	1.9	790.497	6.8	795.397
$\lambda_{DD} [FIT]$	3.332	8.487	571.339	35.773	53.659	583.158	0	583.158	0	583.158	0	583.158	0	583.158
$\lambda_{DU} [FIT]$	2.221	5.658	199.560	22.515	33.773	207.439	1	208.439	12	219.439	1.9	209.339	6.8	214.239
MTTF_d	20555.6	8070.5	148.5	1958.5	1305.7		14155		9512.9		60081.7		16787.5	
SFF	94.795	91.729	89.959	91.514	91.514	90.116	99.145	90.598	99.145	93.756	98.639	90.653	87.659	90.0053

Table 6: Hardware safety integrity: architectural constraints on type A safety-related subsystems.

Safe Failure Fraction	Hardware fault tolerance ***		
	0	1	2
< 60 %	SIL1	SIL2	SIL3
80 % - < 90 %	SIL2	SIL3	SIL4
90 % - < 99 %	SIL3	SIL4	SIL4
≥ 99 %	SIL3	SIL4	SIL4

Table 7: Hardware safety integrity: architectural constraints on type B safety-related subsystems.

Safe Failure Fraction	Hardware fault tolerance ***		
	0	1	2
< 60 %	Not allowed	SIL1	SIL2
80 % - < 90 %	SIL1	SIL2	SIL3
90 % - < 99 %	SIL2	SIL3	SIL4
≥ 99 %	SIL3	SIL4	SIL4

* Numbers for Processor 1 & Processor 2 are included in the Main Brd. number.
 ** Additional 2-wire sensors or thermistor sensors do not affect the calculations.
 ***A hardware fault tolerance of N means that N+1 could cause a loss of the safety function

Table 5: Summary of the Safe Failure Fraction (SFF)

Scully - Setting Standards in Safety and Dependability since 1936.

For over seventy-five years Scully has been engineering and building products to the highest safety and reliability standards. We design and manufacture all of our systems under one roof to ensure complete quality control over our manufacturing and testing operations. Scully is ISO certified and all of our products are 100% made in the U.S.A. In addition, we back up our products with the best service in the industry. We have direct sales and service personnel in the U.S.A., The United Kingdom, and Europe and are represented in over 50 countries.

For more information and 24 hour technical assistance,
call Scully Signal Company at 1-800-2SCULLY (1-800-272-8559).

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