



Installation Guide

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Total Meter Services Inc., 70 Worcester Rd., Toronto, Ont., M9W 5X2, tmsautomation.com

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INTRODUCTION

The TMS Additive Injection System (AIS) uses a combination of mechanical and electrical components and custom-software, to optimize the conventional additive blending procedure applied to gasoline and diesel fuels. These refinements automate the blending procedure, saving the retailer significant amounts of money, time and most importantly, improving the quality of blended fuel for the customer.









The TMS Additive Injection System (AIS) automatically and/or continuously monitors one or more underground storage tanks (UST) to identify when a fuel delivery process (offloading) has begun. During offloading, after a predetermined volume of fuel is delivered (e.g. 20L of fuel) the TMS AIS calculates and injects an appropirate volume of additve into the fuel storage tank. Optimal bending occurs as the small dose of additive immediately mixes with the ongoing fuel delivery (wild stream blending). Additive injections continue until the TMS AIS determines that fuel offloading process has completed.

The TMS AIS will monitor additive quantities and adjust injection volumes to compensate for previous inaccurate additive doses. Additionally, the TMS AIS will adjust additive quatities to compensate for the syphon effect between fuel tanks and fuel distribution (sales) during the offloading.

The TMS AIS uses a combination of;

- Additive pump
- Filter Cartridge
- AIS Flow meter
- Flow control valve
- Solenoid valves
- TMS AIS additive controller panel

to monitor and inject appropriate levels of additive during fuel offloading.

The TMS AIS identifies component failures, lost communications and unexpected additive and fuel volumes with warning lights and shut down procedures. All processes are saved to a database for summary reports and transaction printing.





PURPOSE OF DOCUMENT

This guide covers the installation of the TMS Additive Injection System (AIS) including;

- Safety considerations
- Installation team (roles and responsibilities)
- Components included in the installation kit
- Pre-installation requirements
- Installation of new components
 - Additive controller panel
 - Stainless steel dosing cabinet
- Calibration and configuration

Additionally, the appendix provides suplimentary information including component descriptions, make and model numbers and an alarm matrix.



SAFETY



It is important for everyone on the project to make safety a priority! Read all relevant Operation and Maintenance Manuals and ensure a thorough understanding of all procedures and safety requirements before starting work. Note that specialized skill sets will be required for this installation (e.g. working in a confined space, electrician, pipe fitter). Confirm that the installation team members have the appropriate qualifications for each task before beginning the project.

Most incidents are caused by failure to observe basic safety rules and precautions. Recognizing possible hazards before acting will help to create a safe work environment. Ensure that the project site is identified with hazard pylons and follow appropriate confined space precautions when working in sumps.

The labels on equipment and information located in this document are NOT inclusive. Installers MUST be satisfied that any procedure is safe for themselves and others. Installers must also ensure that procedures do not compromise the safety or function of equipment for future use. If in doubt, it is the Installer's responsibility to obtain clarification from a supervisor or manager.

In general:

- Always focus on the job at hand
- Obey all warning labels
- Replace unreadable or missing labels with new ones before operating equipment
- Do not block burst hoses, pipes or fittings with hands. Fluids under pressure can penetrate skin and cause serious injury
- Do not touch hot surfaces
- Always wear the task specific, recommended, personal protective equipment (PPE). Protective clothing can include a hard hat, safety glasses, ear protection, close fitting clothes, steel toed boots, gloves and a high visibility vest
- Follow the recommended site-specific steps to ensure safe off loading of fuel
- Do not smoke on the project site.
- Never use unauthorized containers for fluid storage or transfer
- Do not attempt to overfill storage tanks
- In the event of a spill, follow site-specific cleanup guidelines





READ ALL FOLLOWING WARNINGS AND CAUTIONS BEFORE INSTALLATION. FAILURE TO FOLLOW THESE INSTRUCTIONS MAY RESULT IN DAMAGE TO EQUIPMENT, FIRE OR EXPLOSION HAZARD, PERSONAL INJURY OR DEATH. ALWAYS REFER TO THE MANUFACTURER'S INSTALLATION AND SERVICE MANUALS FOR ALL EQUIPMENT BEING INSTALLED OR SERVICED ON SITE.

RISK	ASSESSMENT	MITIGATION
Toxic or Hazardous Fumes	During service, the additive contained in the meter box may emit hazardous or toxic fumes into the environment such as Benzene.	Use of a hazardous atmosphere detector ("sniffer") is required during any confined work. All service is to be performed in a ventilated environment or outdoors if possible.
Electrical shock or damage	Incorrect or backwards installation of voltage and neutral lines to the control box may create a situation where electrical shock or electrical damage to equipment may occur.	Always isolate and de-energize all circuits during installation and service. Always follow the installation manual and circuit diagrams during installation and electrical service. Never install live wires.
Mechanical damage	Dropping the control panel or meter box may damage the devices and impair safe operation of the devices. Damaged device components may create electrical, or chemical dangers. Mechanical shock may cause impingement of the meter box enclosure. Friction or impact may cause fire or explosion.	Handle all equipment with care. Do not drop equipment. Install correctly according to installation manual, and do not over-torque any of the product line fittings. If any equipment is damaged, contact TMS for replacement parts. Never attempt to use damaged equipment. Appropriate PPE (gloves, boots, glasses) must be worn by installation crew to prevent personal injury if the equipment is dropped.
Intrinsically safe (I.S.) circuit segregation	Incorrect installation of the I.S. wiring, or failure to segregate the I.S. wiring from signal or supply voltage wiring may result in arcing inside of hazardous atmosphere, creating a risk of explosion or fire	Only install the I.S. wiring to the terminals as shown on the wiring diagram, and as shown on Appendix G. Always keep I.S. wiring segregated from all other voltages and wiring using the shielded section of the control panel.





- Warning: Failure to disconnect and lock out / tag out the supply power before installation or service may result in damage to the devices or permanent or fatal injury.
- Warning: Failure to follow instructions for meter installation may result in non-intrinsically Safe operation. Incorrect operation may result in fire or explosion, and permanent or fatal injuries.
- Warning: The installation team <u>MUST</u> follow the manufacturer's instructions for installation of the meter enclosure including all torque requirements for fittings. Failure to follow instructions may result in the release of additive product into the environment.
- Warning: Failure to follow manufacturer's instructions on electrical installation will void the warranty and may result in damage to the device. Do not connect to power other than a connection at the rating listed in the installation manual.
- Warning: The device must always be protected from mechanical shock. Failure to protect the device from mechanical shock will void the warranty and may damage internal components.
- Caution: All sump work <u>MUST</u> be performed by a team of more than one installer and make use of a harness and tripod rescue system as well as a hazardous atmosphere detector. Any confined space work <u>MUST</u> be performed by a contractor holding valid certification for their jurisdiction. Failure to conform may result in permanent or fatal injury.
- Warning-Explosion Hazard: Potential Electrostatic charging hazard. To reduce the potential Electrostatic charging or discharging hazard, clean enclosure surfaces using water and/or other commercially available anti-static cleaner as part of the regular maintenance
- Warning: Explosion Hazard: Substitution of components may impair intrinsic safety
- Warning: Explosion Hazard: To prevent ignition of flammable or combustible atmospheres, disconnect power before servicing
- Warning-Explosion Hazard: Avoid ignition hazard due to friction and impact





LABEL

Following label must be installed on the Exterior of the AIS Control Panel





Explosion Hazard: To Prevent Ignition Of Flammable Or Combustible Atmospheres, Disconnect Power Before Servicing

Intrinsically Safe Barrier Provides Intrinsically Safe Circuit Extension For Use In Hazardous Location When Installed Per Appendix G.

Control Panel Parameters:

Model: TMS-CP-18053821-2 Voltage: 100-240 V AC @ 50/60 Hz Rating: 3 A Must Be Installed Indoors in Non-Hazardous Environment [Ex ia Ga] IIC; [AEx ia Ga] IIC Operating ambient: 0 to 40 °C





Risque d'explosion: Pour empêcher l'inflammation d'atmosphères inflammables ou combustibles, coupez l'alimentation avant l'entretien

La barrière à sécurité intrinsèque fournit une extension de circuit à sécurité intrinsèque pour une utilisation dans un endroit dangereux lorsqu'elle est connectée selon le schéma de contrôle.





Cert. to CAN/CSA Std. C22.2 No. 61010-1 Conforms to UL Std. 61010-1 and 698A ADDITIVE INJECTION SYSTEM



TOTAL METER SERVICES INC. 70 Worcester Road, Toronto, ON M9W 5X2 TEL: 416-255-5867 www.totalmeter.com





Following label must be installed on the exterior of the AIS Control Panel below IS knock-out



Following label must be installed on the interior of the AIS Control Panel







Following label must be installed on the exterior of AIS Flow Meter Box



TECHNICAL SPECIFICATIONS

Electrical Rating (Control Panel):	100-240 V AC @ 50/60 Hz, 0.16 - 0.384 KVA,
	single phase supply
	Cert. to CAN/CSA Std. C22.2 No. 61010-1.
	Conforms to UL Std. 61010-1 and 698A
Rating:	3 A
Operating Temperature Range:	0°C - 40°C
Operating Humidity Range:	0-75%
Installation requirements (Meter Box):	Zone 0, Div. 1 hazardous environment. Indoor or
	outdoor installation





The AIS must be installed according the the specifications listed above and in accordance with the electrical code of the local jurisdiction. The system is capable of operating in the 100-240 VAC range, and draws a maximum of 0.384 KVA @ 240 V. The internal breaker will open when current above 3A is drawn.

A 15A maximum disconnect switch (circuit breaker) shall be installed upstream of the control.

The temperature and humidity ratings shown above are based on the components that have more sensitive requirements.

The AIS control panel MUST be installed in an indoor facility that will remain heated or cooled to a range within the stated limits. The control panel is not designed or rated for use in hazardous environments.

The stainless steel dosing cabinet can be installed in a Class 1, Zone 0 environment ONLY if the instructions and requirements for Intrinsically Safe (I.S.) wiring are followed exactly.





INSTALLATION TEAM

The installation team will include:

- Project supervisor responsible for;
 - Overseeing the project
 - Ensuring safety is maintaned
 - Co-ordinating the installation team including ensuring tasks are carried out in the appropriate order and with appropriately qualified technicians
- Electrician responsible for;
 - Overseeing and/or performing all electrical work
 - Powering down systems with lock-out procedures
 - Removing the existing additive controller panel
 - Installing the TMS additive controller panel
 - Connecting and disconnecting wiring and electrical components as required.
- Pipe fitter responsible for;
 - Removal and installation of mechanical components and fittings located in and around the stainless steel dosing cabinet and the additive sump, as well as all additive line connections and installs
- Systems intergrater and/or certified TMS AIS technician responsible for;
 - Monitoring system components and signals
 - o Calibrating additive flow rate and flow factor
 - Confirming installation status





INSTALLATION KIT

The installation kit will include:

- Stainless steel additive dosing cabinet
 - One solenoid valve per fuel storage tank. For example a site with two regular and one premium gasoline storage tanks will include 3 solenoid valves. Specifications include:
 - Manufacturer: ASCO
 - Model: C561501
 - Voltage: 24 V/DC
 - One oval gear style meter assembly per additive type. The assembly will contain:
 - AIS Flow meter
 - Manufacturer: Badger Meters
 - Model: 10G-025SSNPT11-XX
 - Size: ¼" Npt threaded
 - Flow valve
 - Manufacturer: NOSHOK
 - Model: 102-FFC
 - Orifice size: 0.172"
 - Check Valves
 - Manufacturer: Ham-let
 - Operating pressure: 1/3 PSI
 - One meter calibration port per additive type
- One replacement filter cartridge
- One TMS AIS Controller Panel

• Manuals and Documentation





PRE-INSTALLATION REQUIREMENTS

Before the installation process begins, ensure that:

- ALL team members review the safety plan which includes;
 - Working in a confined space
 - Working with flamable materials
 - Phone numbers to call in an emergency
 - Problem escallation procedures
 - Contingency plan
 - Quick access (e.g. 1 hr) to replacement parts (i.e. solenoid valves, flow meter, AIS panel components)
 - Backup tools, piping fixtures
 - Contact number for additional support
- Customer site manager and appropriate field staff have been made aware of the planned installation in terms of;
 - Purpose of the installation
 - Systems effected by the installation (what will work, what will not work)
 - o System expectations and operation after the installation
 - Installation time frame (start time, end time)
 - Location of work zone (hazzard pylons in place)
 - Team members identified
- Fuel tanks (premium and regular) are fully additized and have sufficient inventory to operate while additive system is down (4 6 hrs)
- Additive tank has sufficient inventory (approximently 20 liters) to test additive flows during installation procedure
- Deliveries (fuel or additive) are NOT scheduled during the installation time frame
- Installation kit is complete
- Tools are available and in good working condition





INSTALLATION OF NEW COMPONENTS

Installation: Additive Cabinet (Dual Additive System shown below)

The Additive Injection System additive dosing cabinet has mounting brackets along the rear face of the panel, located in each corner (3 across the top and 3 across the bottom of the stainless steel enclosure shown below). The panel should be mounted with lag bolts to a secure structure by the installer such that the panel is located above the piping transition from below to above ground, or above a transition sump if one is being used.

The main steps for the installation of the stainless panel are:

- 1) Mount the panel to a secure structure via lag bolts or clamps
- 2) Install and connect inlet piping
- 3) Install and connect outlet piping
- 4) Install and terminate electrical connections

Inlet Additive Piping

Located at the bottom of the panel (highlighted in the picture) are the additive inlet line connections for both grades (gasoline and diesel) of additive. The factory connections provided by TMS are ¾" NPT thread. The installation team must bring piping from the outlet of the additive pump to the panel, and it is recommended that transition sumps and union-style couplings are used to minimize possible leaks and improve ease-of-service.

Add







Outlet Additive Piping

Located on the bottom face of the additive cabinet are the additive outlet connections (highlighted below). These are 3/8" NPT fittings to accommodate outlet lines to the product tanks for each tank that is to be additized. Each outlet line is associated with a single numbered solenoid and must be connected to the associated numbered product tank via unobstructed piping installed by the installation team in accordance with all local regulations.



The additive lines are numbered and labelled inside of the cabinet at the solenoid valve.





Electrical Connections

The AIS additive cabinet requires two separate electrical runs from the controller unit inside the data hut to the stainless steel cabinet. Located in the middle of the panel on the bottom (highlighted in green in the picture below) is a $\frac{3}{4}$ " NPT conduit to accommodate the solenoid power wiring. The conduit will be connected to a buried conduit or cable run in accordance with local electrical code by a licensed electrician. The solenoids operate at 24V 0.8A DC and the installer shall size the wire in accordance with the local electrical code. The solenoid conduit run requires a total of N+1 wires – 1 signal wire for each solenoid (N) and common 0V return wire (+1).

When mounted, the connection for the Intrinsically Safe meter wiring is located on the bottom of the panel on the right hand side (highlighted in red in he picture below). The provided fitting is a ½" NPT conduit to allow connection to a junction box to allow connection of the 2 additive meters to the field wiring. TMS recommends the use of 18-2C Belden cable or similar shielded conductor to prevent electromagnetic interference with the low-current meter readings. The shielded wire MUST be terminated to a tested ground in the controller panel to provide this protection.







AIS Sump Collar Installation for AIS Plus Systems

Each Emco Containment Sump sold as part of the TMS AIS system for a below-ground mechanical installation will be supplied with a kit of all required fittings. Each kit shall contain: 1x brass 4" male cam lock fitting, 1 4" cam lock seal cap, 1x 4" injection collar, 1x injector stinger, 1x 3/8" short nipple, 1x 3/8" street elbow, 1x 1/3 psi check valve, 1x braided steel flexible hose, 1 compression fit elbow, 1x ¾" ball valve, 3x 3/8" plugs, seal kits provided by Emco. During installation, each threaded component other than the compression fit elbow <u>MUST</u> be installed using either thread sealant compound (pipe dope) or a Teflon tape rated for use with gasolines.



To install the sump, ensure that the existing fill pipe of the underground tank enters through the 4" entry way leaving room at the top of the sump for installation of components, using the provided Emco seal kit. Once mounted on the fill pipe, the electrical connection may be made (1" conduit for the entryway) and the flexible additive pipe may be brought into the sump. The additive pipe swivel may be added after the pipe enters the sump. Use the provided Emco seal kits for each aperture.







Next, attach the injection collar to the fill pipe riser. Note: the ports should not face directly to the steel wall to allow ease of installation of the injection stinger.



Thread the brass cam lock fitting to the injection collar.







Attach the ball value to the additive pipeline swivel such that the value handle is able to full open and close the value.



Attach the compression fit elbow to the ball valve, facing inwards and towards the electrical conduit







Install the injection stinger into the port facing closest to the additive piping. The stinger must be installed so that the "tip" is facing upwards, and the cutout faces downwards. Left is an incorrect install, right is the correct installation.



Thread the close nipple and street elbow onto the injection stinger. The check valve is installed between the street elbow and the braided line. <u>The check valve MUST</u> be installed such that the arrow is pointing toward the stinger.



Attach the braided steel additive line to the check valve and tighten the entire assembly with hand tools. The compression union at the end of the braided hose must be lined up to the elbow





on the ball valve and tightened. <u>This union is the only threaded connection that does NOT use</u> <u>pipe thread sealant of any kind.</u> Use the provided plugs to plug the 3 ports that are not used on the injection collar.



Once assembled, the entire injection system must be pressure tested for leaks before use. Please refer to the AIS Installation Manual for detailed steps. The installer must also install a sump monitor sensor, and use the electrical entry port of the sump to transfer the cable into the sump. No other electrical lines other than sump sensors may enter or exit this electrical conduit.





Installation: AIS Additive Controller Panel

The AIS Additive Controller Panel is to be installed in the Data Hut. The panel should be mounted in the general location of the original additive panel. Installation steps include:

- 1. Confirm that power to the additive pump and control panel is turned off.
- 2. Mount panel to wall.
- 3. Connect power and communication wires to appropriate panel terminals. (See Field Wiring Single/Dual)
- 4. Reconnect power and communications wires.

Step 1: At the STP-CBS control box located in the Data Hut, confirm that power is locked OFF to the additive pump. Note: pilot light should be off.

Step 2: At the Data Hut, confirm that power is locked OFF to the Additive Controller panel.

Step 3: Mount the TMS AIS Additive Controller Panel to the wall in the location of the original additive panel.

Step 4: Connect the power and communication wires to the AIS Additive Controller panel.

Step 5: Reconnect the additive controller terminal block relay and the ethernet cable at the Veeder-Root panel.















**See Appendix B & C for wiring Diagrams





Installation: AIS Kit Installation

The AIS Kit is a flexible system comprised of 1 environmentally sealed flow meter per additive and 1 solenoid injection kit per tank. The AIS Kit flow meter and solenoid valves are installed in the containment sump of the additive tank, closer to the point of operation, and product tanks respectively. This configuration is beneficial for smaller sites where mounting additional system equipment is not feasible.

The AIS Kit flowmeter must be installed in the additive fill containmnet sump on the outlet of the additve pump filter housing, using the flexible braided steel additive lines provided with the kit.

On the additive filter pump housing, install a new filter cartridge and the submersible enclosure box containing a flow meter and flow control valve. Installation steps include:

- 1) At the pump control contactor panel, located in the electrical room, confirm that the power is locked OFF to all additive pumps.
- 2) Confirm the power is locked OFF to the additive controller located in the electrical room
- Move to the additive sump location and confirm that all confined space equipment (tripod, harness, gas detector) is present and in good condition and the gas detector is activated.
- 4) Record the CRN numbers for TSSA or equivalent certification authority
- 5) Position a spill kit under the work area inside of the sump
- 6) Attach the meter enclosure box to the outer sheath of the additive fill pipe
- 7) Attach the braided steel additive inlet line from the outlet of the additive pump filter housing to the inlet side of the meter enclosure box. Note: the additive meter enclosure inlet fitting is a ½" NPT thread, as is the braided steel additive line. Bushings may be required depending on filter housing outlet thread size.
- 8) Attach the braided steel additive outlet line (includes a 'T' fitting and a ball valve for calibration) from the outlet of the additive meter enclosure box to the additive piping that exits the sump and transitions to the product tanks.
- 9) Ground the flow meter piping using the provided ground clamp in the enclosure box.
- 10) Connect pulser wires from the meter according to the wiring diagram in appendix B or C, as listed
- 11) Install a new filter cartridge in the additive filter housing





CALIBRATION AND CONFIGURATION

Post Installation Procedure

After the installation of ALL the components, complete the following steps;

- 1. Power up the TMS AIS additive control panel including:
 - Remove the locks (lockout tags)
 - Turn power on to the STP-CBS control box and the additive control panel
 - Note: Initial alarm LEDs on the additive control panel should turn off and the OK light should turn on.
 - If the alarm LED remains on and no ticket is printed, the software is unable to connect to the TLS.
 - If the alarm LED remains on and a ticket is printed, the system is unable to connect to the relay board.
- 2. Power up the STP-CBS control box. Note: pilot light should not turn on.
- 3. Test and configure the system with computer generated flows including:
 - Check that solenoids are opening and closing (sound)
 - Turn additive pump on and check for leaks in the additive line
 - Turn additive pump on and use calibration ball to flow additive into a container for system priming. .The calibration ball valve is located inside of the stainless panel for the AIS Plus. For the AIS Kit it is located on the outlet of the additive meter on the braided steel line.
 - Priming the system open the calibration valve and flow additive into the calibration beaker until no more air is visible in the additive in the calibration beaker. May require 1-3 gallons.
 - Calibrate flow control valve
 - Turn additive pump on and use calibration valve at the cabinet to flow additive into a measuring tube.
 - Confirm flow rate with actual additive dispensed. Adjust calibation factor as required.
 - Record calibration data on back of submersible enclosure
- 4. Test the system with a fuel delivery including:
 - o Schedule a tanker for delivery
 - Monitor the TMS AIS panel for warning and alarm LEDs
 - Check fill and additive sumps for leaks at installation points and at new components
 - o Check printout of offloading transaction and confirm expected quanties







- Review TMS AIS data for expected quantities
- 5. Reinstall manhole covers and bolt into position.

REVIEW SERVICE MANUAL FOR ADDITIONAL INFORMATION





Solenoid Valve

A solenoid valve, controlled by electrical signals from the AIS Controller, opens and closes, enabling precise volumes of additive to be injected into each fuel storage tank.



Specifications Manufacturer: ASCO Model: Red Hat, C561501 Voltage: 24 V/DC Default state: Closed

Quantity: 1 per fuel storage tank

Process Location:







AIS Flow Meter

A flow meter measures the volume and flow rate of additive injected into the fuel storage tank/s. Data collected by the AIS flow meter is sent to the AIS Controller Panel which enables real time additive flow rate calculations. Additionally, the AIS flow meter will identify unexpected flow/no flow conditions, enabling the AIS to activate warnings and shut down the system as required. Note that the AIS flow meter is protected within a submersible enclosure box.



Specifications

Manufacturer: Badger Meters

Model: IOG-025SSNPT11-XX

Size: ¼" Npt threaded

Max Pressure: 69 Bar / 1000 psi

Max Length of IS Wiring (including field connections): 150 M / 500'

Transmitter: Oval Gear

Calibration: Factory to pulses/liter

Quantity: 1 per additive tank

Process Location:





Flow Control Valve

A flow control needle valve optimizes the additive flow rate. An optimized additive flow rate increases the precision of the AIS flow meter, ensuring accurate additive injections. Note that the flow control valve is protected within a submersible enclosure box and factory set with a flow rate of 6.0 L/M.



Specifications Manufacturer: NOSHOK Model: 102-FFC Orifice Size: 0.172" Pressure Rating: 10,000 psi @ 200 °F Quantity: 1 per flow meter

Process Location:



AIS





Filter Cartridge

A filter cartridge is used to filter impurities from the additive, improving reliability and extending the durability of the system.



Specifications Manufacturer: Model:

Quantity: 1 per site

Process Location:







AIS Controller Panel

An AIS Controller Panel;

- Enables site customization (number of tanks, additive ratios, injection frequence rate, etc.)
- Collects real-time data from the system
- Calculates additive injection volumes and timing
- Activates solenoid/s to ensure precise additive injections
- Adjusts additive dose/s to compensate for under/over dosed fuel
- Saves processes to a data base
- Enables process printing
- Activates warning lights (LEDs) to indicate component failure and/or unexpected fluid flow

TMS AIS Controller Panel (one per site):









APPENDIX B - SINGLE SYSTEM TERMINATIONS







APPENDIX C - DUAL SYSTEM TERMINATIONS







APPENDIX D - TROUBLESHOOTING







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APPENDIX D - TROUBLESHOOTING

If an alarm LED is active on the additive control panel try the following:

- Press the RESET button.
- Check TLS cable, unplug and plug cable back into PC.
- Review Service Manual for potential issues.
- Contact TMS at:

Total Meter Services

70 Worcester Rd.,

Toronto, Ontario

M9W 5X2

Call:

Monday to Friday, 8 a.m. to 5 p.m. EST: (416) 225-5867 OR: (416) call TMS option #2 Toll Free: (844) 425-5867 After Hours: (416) 225-5867 OR: (416) call TMS option #2 Toll Free: (844) 425-5867

Note: If calling after hours, please clearly leave your name, telephone number and the nature of your call. A technician will contact you as soon as possible.





APPENDIX E - IS BARRIER CONTROL DRAWINGS

Connections



Notes

- 1. The intrinsically safe wiring must be installed in accordance with the Canadian Electrical Code CSA C22.1, Part 1, Appendix F
- Barrier listed in the Table 1 shall not be connected to any device that uses or generate in excess of 250Vrms or DC unless it has been determined that the voltage is adequately isolated from the barrier. Barriers listed in Table 2 shall not be connected to any device that uses or generates in excess of 60Vrms or DC unless the voltage is limited by an adequate means
- 3. Any combination of up to 10 channels of the barriers listed in Table 1 or Table 2 may be connected in parallel and connected to a switch in a hazardous location.
- 4. The Entity concept allows interconnection of intrinsically safe apparatus with associated apparatus not specifically examined in combination as a system when the approved values of Voc and lsc for the associated apparatus are less than or equal to Vmax or Imax for the intrinsically safe apparatus and the approved values or Ca and La for the associated apparatus are greater than Ci + Ccable and Li + Lcable, respectively, for the intrinsically safe apparatus.
- The following models with part number greater than 100000 are approved for mounting in Class I, Zone 2, Groups IIC, IIB and IIA or Class I, Division 2, Groups A,B,C,D hazardous (classified) location: KF**-SR2-EX1.W, KF**-SR2-EX1.W.LB, KF**-SR2-EX2.W, KF**-SR2-EX2.2S, KFD2-ST2-EX1.*, KFD2-ST2-EX2.*, KFD2-SOT2-EX1.*, KFD2-SOT2-EX2.*

WARNING: Substitution of components may impair intrinsic safety and suitability for use in Class I, Division 2 / Zone 2 $\,$

AVERTISSEMENT - La substitution de composants peut compromettre la sécurité intrinsèque et l'adéquation à une utilisation en Classe I, Div. 2/Zone 2.

This document contains safety-relevant information. It must not be altered without the authorization of a NE EX					
	Only valid as long as released in EDM	date: 05-08-2015			
PEPPERL+FUCHS	Control Drawing	116-0047K			
Global	Switch Isolators	sheet 1 of 2			





APPENDIX E - IS BARRIER CONTROL DRAWINGS

Entity Parameters

Table 1: Barrier Certified to CSA Standard C22.2 No. 157 (Um = 250 V)

		Sys	em ENTITY								
Model Numbers	Termi nals	i Vmax(V)	Res. (Ω)	Uo Voc	lo Isc	Co(µF) GRPS			Lo(mH) GRPS		
						IIC A,B	IIB C,E,F,G	IIA D	IIC A,B	IIB C,E,F,G	IIA D
KFA5-SR2-Ex1.* KFA5-SR2-Ex2.* KFA6-SR2-Ex1.* KFA6-SR2-Ex2.* KFD2-SR2-Ex1.* KFD2-SR2-Ex2.*	1-3 2-3 4-6 5-6	12.6	650	12.9	19.8	1.273	3.820	10.18	84.88	298.7	744.4
KFA5-SOT2-Ex1.* KFA5-SOT2-Ex2.* KFA6-SOT2-Ex1.* KFA6-SOT2-Ex2.*	1-3 2-3 4-6 5-6	10.5	811	10.5	13.0	2.66	7.9	21.3	192	671	1000

Table 2: Barrier Certified to CSA Standard E79-11 (Um = 60 V)

	Terminals	Load Parameters							
Model Numbers Termi		lls Uo (Voc)	lo (Isc)	Co(µF) GRPS			Lo(mH) GRPS		
				IIC A,B	IIB C,E,F,G	IIA D	IIC A,B	IIB C,E,F,G	IIA D
KFD2-SOT2-Ex1.* KFD2-SOT2-Ex2.* KFD2-ST2-Ex1.* KFD2-ST2-Ex2.*	1-3 2-3 4-6 5-6	10.5	13.0	2.66	7.9	21.3	192	671	1000

The values of Lo and Co listed in the table above are allowed if one of the following conditions is met:

- The total Li of the external circuit (excluding the cable) is < 1% of the Lo value or

The total Li of the external circuit (excluding the cable) is < 1% of the Lo value of the covalue.
The values of Lo and Co listed in the table above shall be reduced to 50% when both of the following conditions are met:
the total Li of the external circuit (excluding the cable) is > 1% of the Lo value and
the total Ci of the external circuit (excluding the cable) is > 1% of the Co value.

Note: the reduced capacitance of the external circuit (including cable) shall not be greater than 1uF for IIA, IIB and 600nF for IIC.

This document contain	ns safety-relevant information. It must not be altered without the authorization	tion of a NE EX
	Only valid as long as released in EDM	date: 05-08-2015
PEPPERL+FUCHS	Control Drawing	116-0047K
Global	Switch isolators	sheet 2 of 2



APPENDIX F – IS BARRIER INSTRUCTIONS

Instruction Manual

Marking

K-System, Isolated barriers for Zone 2
Device identification
Model number
ATEX approval
Group, category, type of protection, temperature classification

The exact designation of the device can be found on the name plate on The exact designation of the docted and the device side. Pepperl+Fuchs GmbH Lilienthalstrasse 200, 68307 Mannheim, Germany

table 2

Target Group, Personnel

Responsibility for planning, assembly, commissioning, operation maintenance, and dismounting lies with the plant operator.

Mounting, installation, commissioning, operation, maintenance and dismounting of the device may only be carried out by appropriate trained and qualified personnel. The instruction manual must be read and understood. Prior to using the device you should make yourself familiar with the device and experimental transfer to the structure manual of the structure of the structure

and carefully read the instruction manual.

Reference to Further Documentation

Observe laws, standards, and directives applical and the operating location. . le to the intended use and the operating location. The corresponding datasheets, declarations of conformity, EC-type-examination certificates, certificates and control drawings if applicable supplement this document. You can find this information under www.pepperl-fuchs.com.

Intended Use

The device is only approved for appropriate and intended use. Ignoring these instructions will void any warranty and absolve the manufacturer from any liability.

The device is used in control and instrumentation technology The device is used in control and instrumentation technology (C&I technology) for the galvanic isolation of signals such as 20 mA and 10 V standard signals or alternatively for adapting or standardizing signals. The device has intrinsically safe circuits that are used for operating intrinsically safe field devices in hazardous areas. Use the device only within the specified ambient conditions. The device is designed for mounting on a 35 mm DIN mounting rail according to EN 60715. Only use the device is an associated apparatus according to IEC/EN 60079-11. The device is an electrical apparatus for hazardous areas of Zone 2. Immroner IIse

Improper Use

Protection of the personnel and the plant is not ensured if the device is not being used according to its intended use. The device is not suitable for isolating signals in power installations unless

this is noted separately in the corresponding datasheet.

Mounting and Installation

Nounting and installation Do not mount a damaged or polluted device. Mount the device in a way that the device is protected against mechanical hazard. Mount the device in a surrounding enclosure for example. Do not mount the device in the dust hazardous area. The device fulfills a degree of protection IP20 according to IEC/EN 60529.

The device tuillis a degree of protection IP20 according to IEC/EN 605 The device must be installed and operated only in an environment that ensures a pollution degree 2 (or better) according to IEC/EN 60664-1. If used in areas with higher pollution degree, the device needs to be protected accordingly. All circuits connected to the device must comply with the overvoltage category II (or better) according to IEC/EN 60664-1. Only use power supplies that provide protection against electric shock (e.g. SELV or PELV) for the connection to power feed modules. Observe the installation instructions according to IEC/EN 60079-14. Bequirements for Cables and Connection I inse

Requirements for Cables and Connection Lines

Observe the following points when installing cables and connection lines: Observe the permissible core cross-section of the conductor. If you use stranded conductors, crimp wire end ferrules on the conductor ends

Use only one conductor per terminal. When installing the conductors the insulation must reach up to the

Terminal. Observe the tightening torque of the terminal screws. If the rated voltage is greater than 50 V AC, proceed as follows: 1. Switch off the voltage.

2 Connect the terminal blocks or disconnect the terminal blocks.

Requirements for Usage as Associated Apparatus If circuits with type of protection Ex i are operated with non-intrins safe circuits, they must no longer be used as circuits with type of protections Ex i non-intrinsically

safe circuits, they must no longer be used as circuits with type of protection Ex i. Intrinsically safe circuits of associated apparatus can be led into hazardous areas. Observe the compliance of the separation distances to all non-intrinsically safe circuits according to IEC/EN 60079-14. Observe the compliance of the separation distances between two adjacent intrinsically safe circuits according to IEC/EN 60079-14. Observe the maximum values of the device, when connecting the device to intrinsically safe apparatus.

When connecting intrinsically safe devices with intrinsically safe circuits of associated apparatus, observe the maximum peak values with regard to explosion protection (verification of intrinsic safety). Observe the standards IEC/EN 60079-14 or IEC/EN 60079-25. If no L₀ and C₀ values are specified for the simultaneous appearance of lumped inductances and capacitances, the following rule applies. • The specified value for L₀ and C₀ is used if one of the following conditions and the following conditions another the same set of the same set of

- tions applies: The circuit has distributed inductances and capacitances only, e. g., in
- cables and connection lines. The total value of L_i (excluding cable) of the circuit is < 1 % of the spe-
- The total value of C_i (excluding cable) of the circuit is < 1 % of the spe-
- The total value of C₁ (excluding cable) of the circuit is < 1% of the specified C₀ value.
 A maximum of 50 % of the specified value for L₀ and C₀ is used if the following condition applies: The total value of L_i (excluding cable) of the circuit is ≥ 1 % of the spe-

The total value of C₁ (excluding cable) of the circuit is ≥ 1 % of the specified L₂ value. The total value of C₁ (excluding cable) of the circuit is ≥ 1 % of the specified C₀ value.

citied C₀ value. The reduced capacitance for gas groups I, IIA and IIB must not exceed the value of 1 μ F (including cable). The reduced capacitance for gas group IIC must not exceed the value of 600 nF (including cable). If more channels of one device are connected in parallel, ensure the parallel connection is made directly at the terminals of the device. When verifying the intrinsic safety, observe the maximum values for the parallel connection.

Requirements for Equipment Protection Level Gc

ling enclosures and operated only in su that

with the requirements for surrounding enclosures according to Comply with the requirements for surrounding choices according to IEC/EN 60079-0.
 are rated with the degree of protection IP54 according to IEC/EN 60529

Connection or disconnection of energized non-intrinsically safe circuits is only permitted in the absence of a potentially explosive atmosphere. Provide a transient protection. Ensure that the peak value of the transient protection does not exceed 140 % of the rated voltage. Place warning label "Warning – Do not remove or replace fuse when energized!" visibly on the housing.

Operation, Maintenance, Repair

The devices must not be repaired, changed or manipulated. If there is a defect, the product must always be replaced with an original device. If the rated voltage is greater than 50 V AC, proceed as follows: 1. Switch off the voltage.

2. Connect the terminal blocks or disconnect the terminal blocks.

Requirements for Equipment Protection Level Gc

Connection or disconnection of energized non-intrinsically safe circuits is only permitted in the absence of a potentially explosive atmosphere. Only use operating elements in the absence of a potentially explosive atmosphere.

atmosphere. Only use the programming socket in the absence of a potentially explosive atmosphere

Only change the replaceable fuse, when the device is de-energized.

Delivery, Transport, Disposal

Check the packaging and contents for damage. Check if you have received every item and if the items received are the ones you ordered. Always store and transport the device in the original packaging. Store the device in a clean and dry environment. The permitted ambient conditions (see datasheet) must be considered.

Disposing of device, packaging, and possibly contained batteries must be in compliance with the applicable laws and guidelines of the respective country. country.

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APPENDIX G – TMS IS BARRIER CONTROL DRAWING



Note:

1. Usage quantity of flow meter vary with the system; i.e.: qty 1 and 2 for single and dual system.

2. Only the conductors shown within the cable shall be used. Each unused conductor shall be cut at 5mm min. interval from the edge of the outer jacket, folded and added with heat shrinkable tube incorporating the used conductors. Cable can be extended up to 500 ft. max.. If meter wire is extended, use appropriate wire nuts (or similar) within a weatherproof junction box.

3. The IS barrier shall be installed in accordance with NEC (National Electrical Code) and/or CEC (Canadian Electrical Code). The IS barrier wiring to the flow meter shall be mechanically secured and isolated from non-IS circuits by a minimum of 50mm. Additionally, boundary seals shall be installed on IS wirings exiting from hazardous to ordinary locations.

4. All accessible non-current carrying metal parts attached on the flow meter enclosure shall be bonded to ground in end application.

5. To avoid static build-up, clean the external surfaces of the flow meter enclosure regularly using commercially available static cleaner or equivalent cleaning means