

TS Series

*TRUNSAFE® Fault Tolerant
Fieldbus System*

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Fieldbus System*

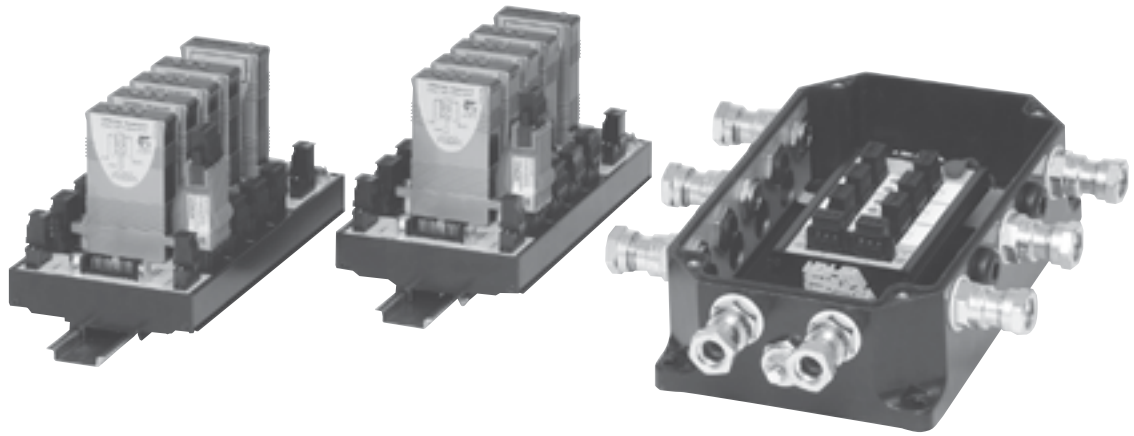


Table of Contents

Introduction.....	3
TRUNKSAFE System Configuration.....	4
Specifications	5
Dimensions.....	6
Installation	11
TPS201-4 DIN Carrier Units.....	11
TPS202 Advanced Power Conditioner	11
FDM252 Fieldbus Diagnostics Module.....	11
SPM201 Surge Protection Module.....	12
TS200 Series Device Couplers	12
Terminal Designations	13
Wiring Connections	14
Terminator	14
Grounding.....	15
Case Ground.....	15
Shield Ground	15
Surge Ground.....	15
TS200 Device Coupler	15
Recommended Ground Wiring Practices	15
CE Conformity	16
Testing & Troubleshooting.....	17
LED Operation.....	17
Operation.....	18
Maintenance.....	18
Customer Support	19
Control Drawings	16
HOST Interface Kits.....	23
Appendix A: TRUNKSAFE / Emerson DeltaV System Configuration	24
Appendix B: TRUNKSAFE / Yokogawa CENTUM System Configuration	25
Appendix C: TRUNKSAFE / ABB System 800 Configuration	26
Appendix D: TRUNKSAFE / Honeywell System Configuration.....	27
Appendix E: TRUNKSAFE / Invensys System Configuration	28
Appendix F: TRUNKSAFE / Profibus System Configuration.....	29
Return and Warranty Procedures	30

Introduction

The TPS200 TRUNKSAFE Fault-Tolerant Fieldbus System enables fault-tolerant FOUNDATION fieldbus H1 and PROFIBUS PA segments. TRUNKSAFE works with any Host configuration using a simplex or redundant interface. A secure fieldbus physical layer is made possible through the combination of a Host Interface Kit, two redundant fieldbus DC Power Conditioners and the specially engineered TRUNKSAFE Device Coupler. This ensures that TRUNKSAFE will maintain normal segment communications even in the event of Host interface failure¹, power conditioner failure or an open- or short-circuit of any cable between the Host Interface and the field based device coupler.

TRUNKSAFE is FOUNDATION fieldbus® registered and fully compliant with FF831-1 (the technical specification for fieldbus power supplies) and FF846-1 (the technical specification for device couplers).

TRUNKSAFE is fully compliant with IEC61158-2, the fieldbus physical layer standard, and requires no modifications to fieldbus devices or to Host software.

TRUNKSAFE System Configuration

Figure 1 shows a TRUNKSAFE system configuration and illustrates how TRUNKSAFE maintains continuous segment communications between the Host and field devices in the event of any single point failure, such as an open or short circuit.

(Refer to Appendices for specific Host wiring configurations. Contact MooreHawke if wiring configurations for alternative Host systems are required)

The TPS200 TRUNKSAFE Fault-tolerant Fieldbus System is comprised of three main sections: Host Interface, Power Conditioning, and a single field-based device coupler

The Host Interface, which is unique to each Host vendor, provides two trunk outputs that will be carried all the way to the device coupler in the field. Typically this is done with redundancy adapters connected to the Host interface (See Appendices). Additional interface adapters (when needed) ensure that active modules can be replaced without shutting down communications. The resultant two trunk outputs begin the redundant segment, and are then wired to separate fieldbus power supply carrier boards. In most cases this is accomplished with a plug-to-plug cable connector carrying four segments.

Power conditioning is provided by the TRUNKSAFE fieldbus power supply which comprises a DIN Carrier (TPS201-4) populated with up to four Advanced Power Conditioner Modules (TPS202), optional surge protection (SPM201) and one Fieldbus Diagnostics Module (FDM252). Each trunk is connected to a separate carrier board (TPS201-4) of the TRUNKSAFE fieldbus power supply. Each carrier board supports four trunks with an individual power conditioning module (TPS202) and a segment terminator for each trunk.

A Fieldbus Diagnostics Module (FDM252) must be fitted onto the DIN Carrier (one Module mounted per Carrier) in order to provide alarm and diagnostics information. It provides LED indicators for DC power status, cable open- and short-circuits, noise on each segment and a common contact closure (opens upon alarm).

The optional Surge Protection Module, SPM201, provides a full 3-element surge suppression circuit per segment. The SPM201 fits directly onto the DIN Carrier pluggable terminal socket (field-side) for the segment being protected. This eliminates the need for additional panel wiring or mounting space. A ground connection for surge protection is provided through a bus bar located within the DIN Carrier. Ground is made externally available as a separate grounding stud.

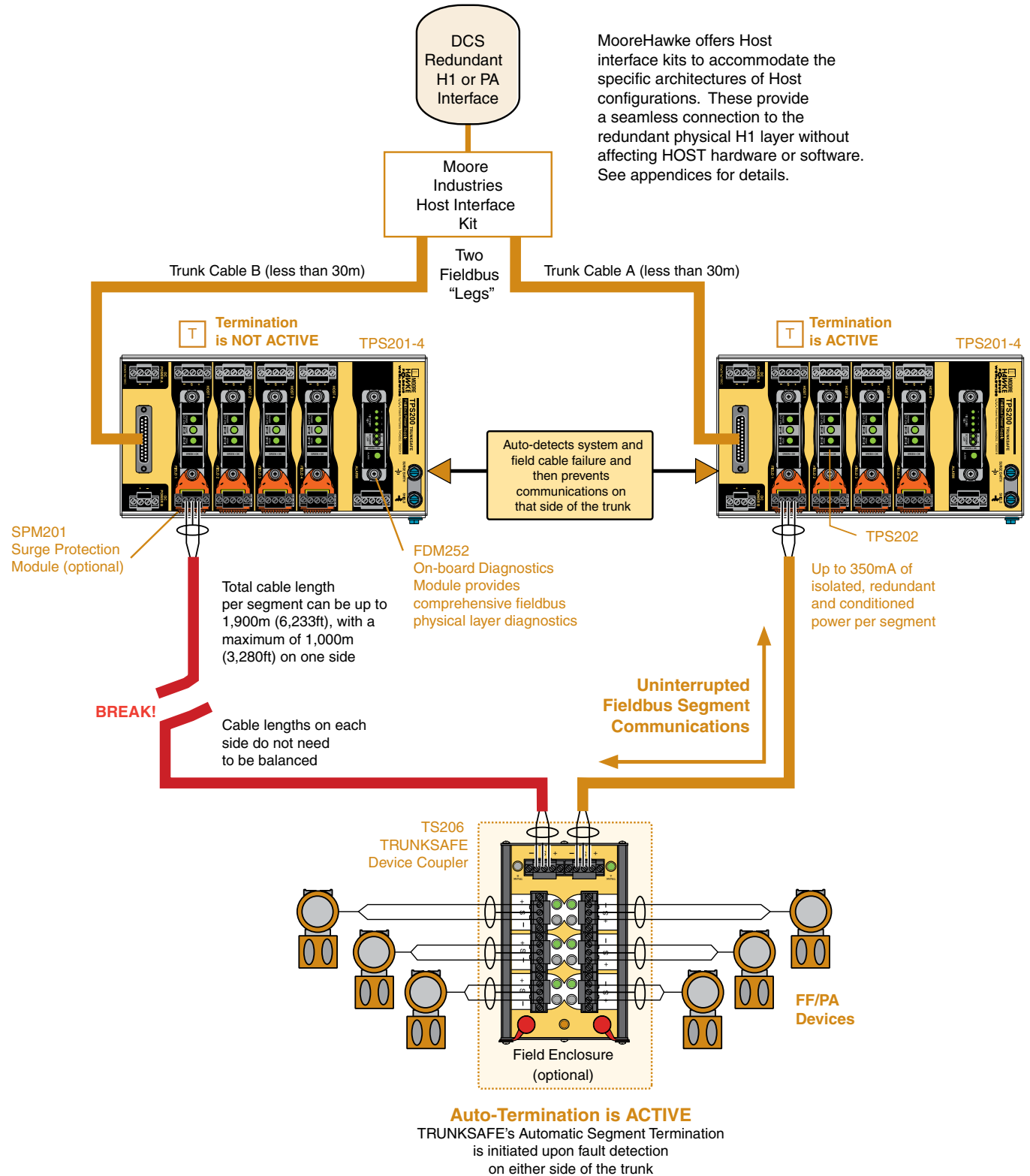
The single field-based device coupler receives power and communications from each trunk. It can support up to 6 (6 way) or 12 (12 way) devices. The TS200 Series device coupler is a specially engineered device coupler with redundancy, automatic terminator, and spur short circuit protection built into the coupler. In addition, each coupler has led indicators for each trunk, spur (normal and short circuit) and auto-terminator.

¹At time of this publication, PROFIBUS PA does not support redundant interface cards.

TS Series

TRUNSAFE® Fault Tolerant
Fieldbus System

Figure 1. TRUNSAFE System Configuration - Redundant operation



Specifications

<p>Performance TPS201-4 Power Conditioner DIN Carrier Number of Segments: 4 Supply Voltage: 19.2 to 32Vdc, reverse polarity protected</p> <p>Terminals Type: Removable terminals with screw-clamp retaining screws Wire Size: Handles 0.8-2.5mm²/12-24AWG cable sizes</p> <p>Performance TPS202 Power Conditioner Module Output Capacity: 350mA per segment; up to 25.5V (no load) Power Requirements: 13.5VA @350mA per segment Power Dissipation: 5.5W @350mA per segment Terminator: 100 ohms/1microFarad per segment DC/DC Isolation: 500Vdc (segment to power supply)</p> <p>Indicators LED (Power): GREEN, normal; ORANGE, Output Voltage <18V LED (Short): GREEN, normal; RED, Cable Short LED (Open): GREEN, normal; RED, Cable Open</p>	<p>Performance FDM252 Fieldbus Diagnostics Module Power Dissipation: 0.5W maximum</p> <p>LED Indicators LED Type: GREEN, Normal; RED, Fault LED A: DC "A" Input Voltage Low (<18V) LED B: DC "B" Input Voltage Low (<18V) LED 1: Segment #1 Noise High (>75mV p/p) LED 2: Segment #2 Noise High (>75mV p/p) LED 3: Segment #3 Noise High (>75mV p/p) LED 4: Segment #4 Noise High (>75mV p/p)</p> <p>Alarm Relay Output Type: Relay (failsafe, open on alarm) Contact Rating: 5A@250Vac 50/60Hz or 24Vdc, non-inductive load</p>	<p>Performance SPM201 Surge Protection Module Complies with: -IEC 61158-2, for 31.25kB/s and testing according to -IEC 61643-21 Maximum Surge Current Isn: 20kA (8/20µsec) Nominal Discharge Current Isn: 3kA(8/20µsec) Nominal Rated Current In: 650mA Maximum Continuous Operating Voltage (MCOV): 35V Peak Common Mode: 230V Limiting Voltage Vlim: 50V@3kA (8/20µsec) Nominal Voltage Vn: 32V Line Attenuation: Rs: 1 ohm capacitance:1nF IP Rating: IP20</p> <p>Ambient Conditions (All TPS400 Components and Options) Operating Range: -20°C to +60°C (-4°F to +140°F) Storage Range: -40°C to +85°C (-40°F to +185°F) Relative Humidity: 0-95%, non-condensing RF/EMI Immunity: 10V/m@80-1000MHz, 1kHz AM when tested according to IEC61326</p>
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TRUNSAFE Fieldbus Device Coupler (TS200)

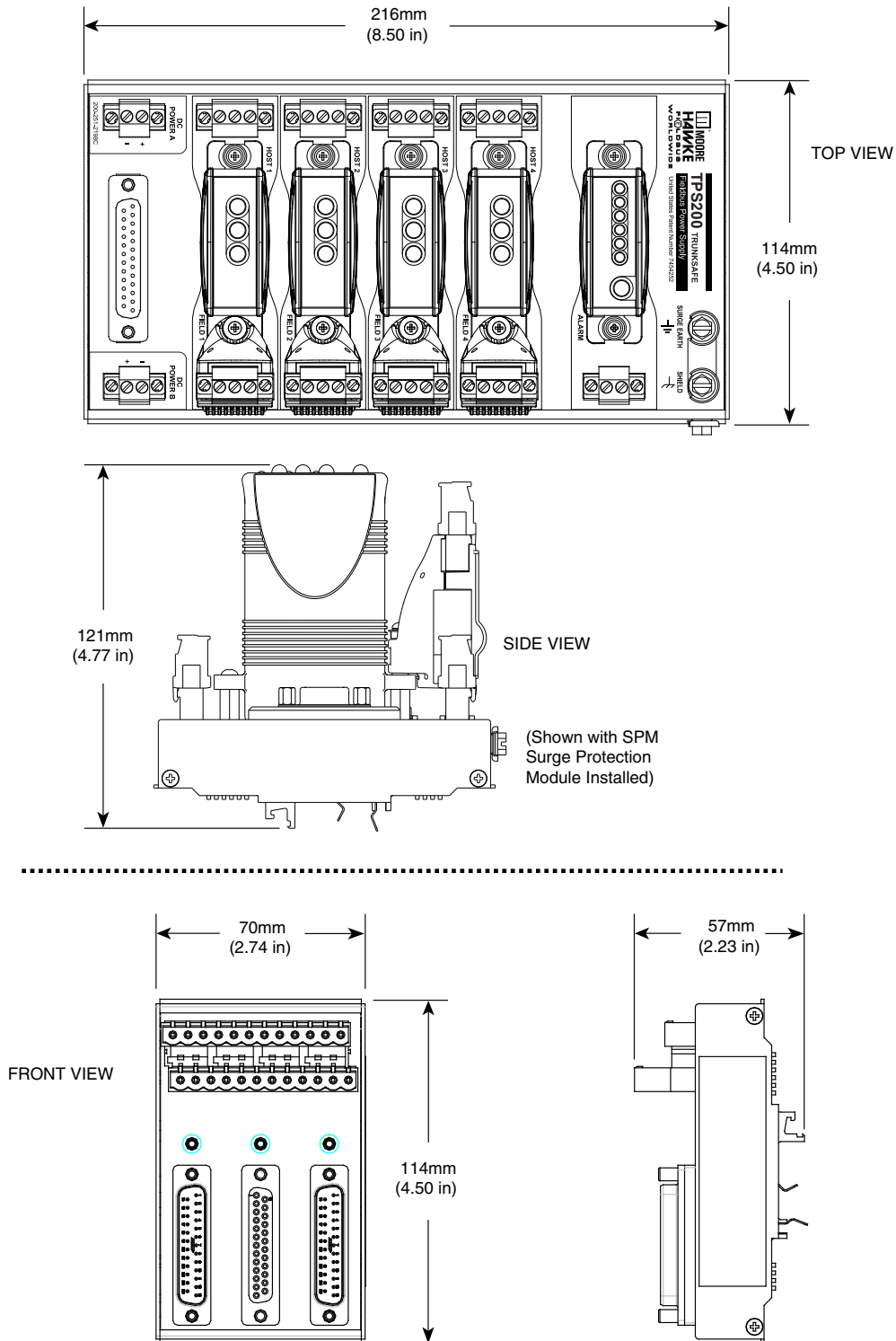
<p>Communications FOUNDATION Fieldbus™ H1 or PROFIBUS PA</p> <p>Performance Maximum Quiescent Current: TS206: 13.5mA TS20W: 25mA Maximum Spur Output Current: I_{spur} =48mA Spur Short Circuit Load: I_{ssc} 2mA (typical)/6mA max. Spur Voltage Drop: 0.5V @20mA spur current (typical), 1V maximum Maximum Spur Voltage: 24V max. no load</p>	<p>LED Indicators Trunk: GREEN (Active); OFF (Inactive) Spur: GREEN (Normal); RED (Fault) Auto-Terminator: YELLOW (Terminator On); OFF (Terminator Off)</p> <p>Terminals Type: Removable terminals with screw-clamp retaining screws Wire Size: Handles sizes between 0.8-2.5mm²/12-24AWG</p> <p>Enclosures (Optional) Type: Aluminum IP66; Stainless Steel 316 IP66; GRP (Glass Reinforced Polyester) IP66</p>	<p>Cable Gland (Device Couplers with Enclosures) Type: Armored/ Unarmored Material: Nickel-plated brass</p> <p>Ambient Conditions Operating Range: -40°C to +70°C (-40°F to +158°F) Storage Range: -40°C to +85°C (-40°F to +185°F) Relative Humidity: 0-95%, non-condensing RF/EMI Immunity: 10V/m@80-1000MHz, 1kHz AM when tested according to IEC61326</p>
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TS Series

TRUNSAFE® Fault Tolerant
Fieldbus System

Dimensions

Figure 2. TPS201/202 Advanced Power Conditioner and Generic Redundancy Adapter with DIN-Rail Mounting Installation Dimensions



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Figure 3-A. TS200 Device Coupler DIN-Rail Mounting Installation Dimensions (Base Unit)

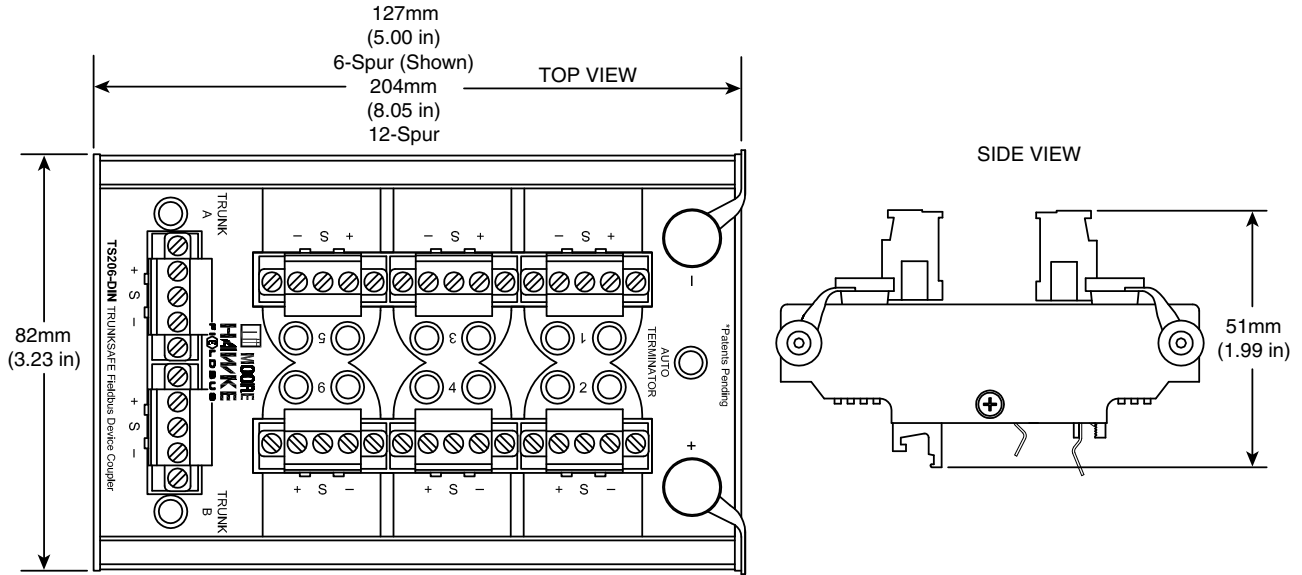
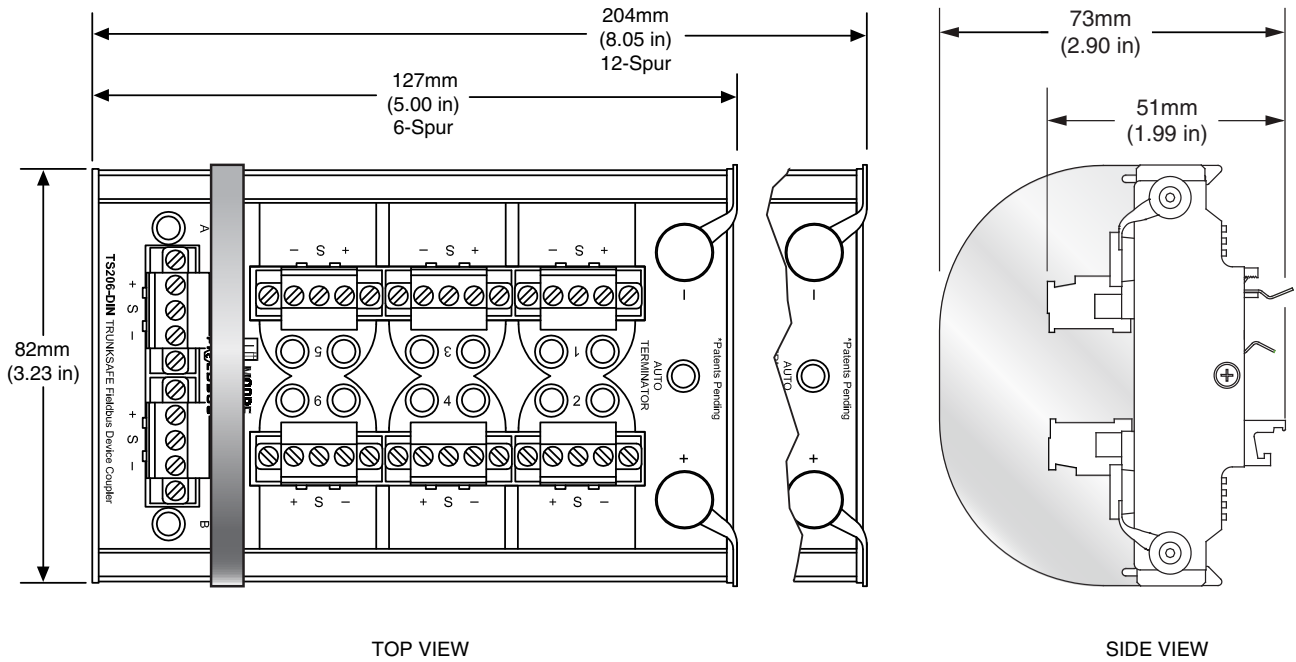


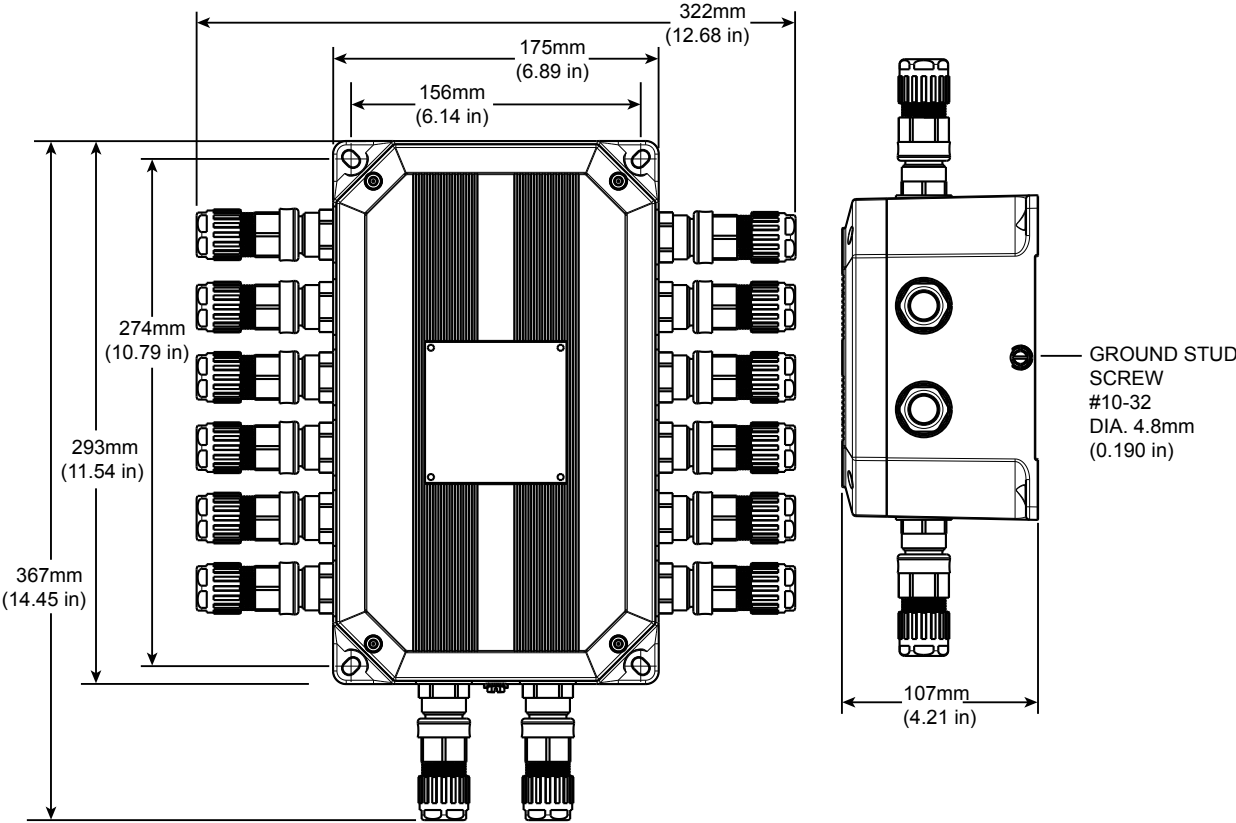
Figure 3-B. DIN-Rail Mounting Installation Dimensions with Optional ATEX barrier



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TRUNSAFE® Fault Tolerant
Fieldbus System

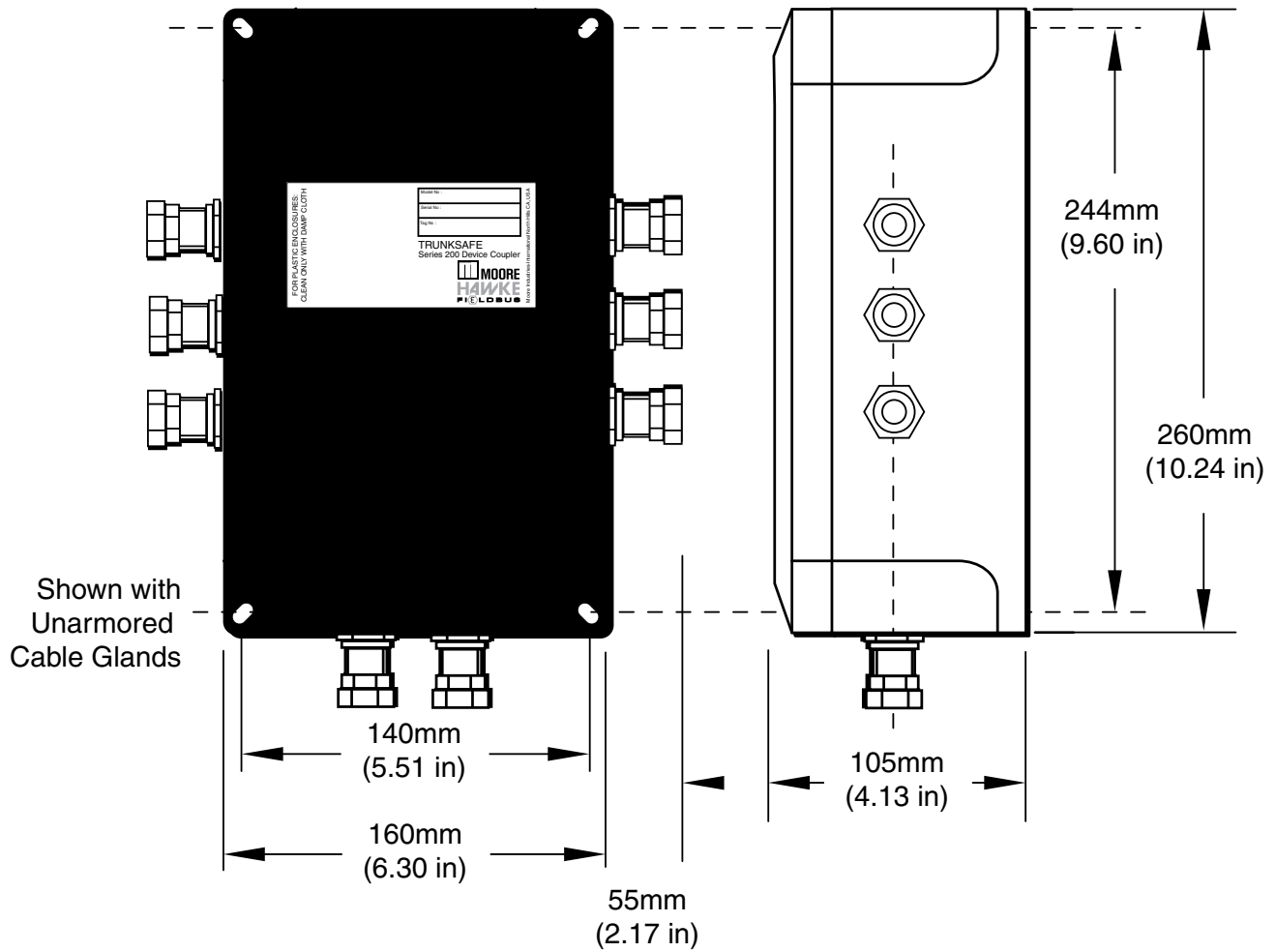
Figure 4. Standard Aluminum Enclosure Installation Dimensions for 6-Spur (TS256) and 12-Spur (TS25W) Models



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Fieldbus System

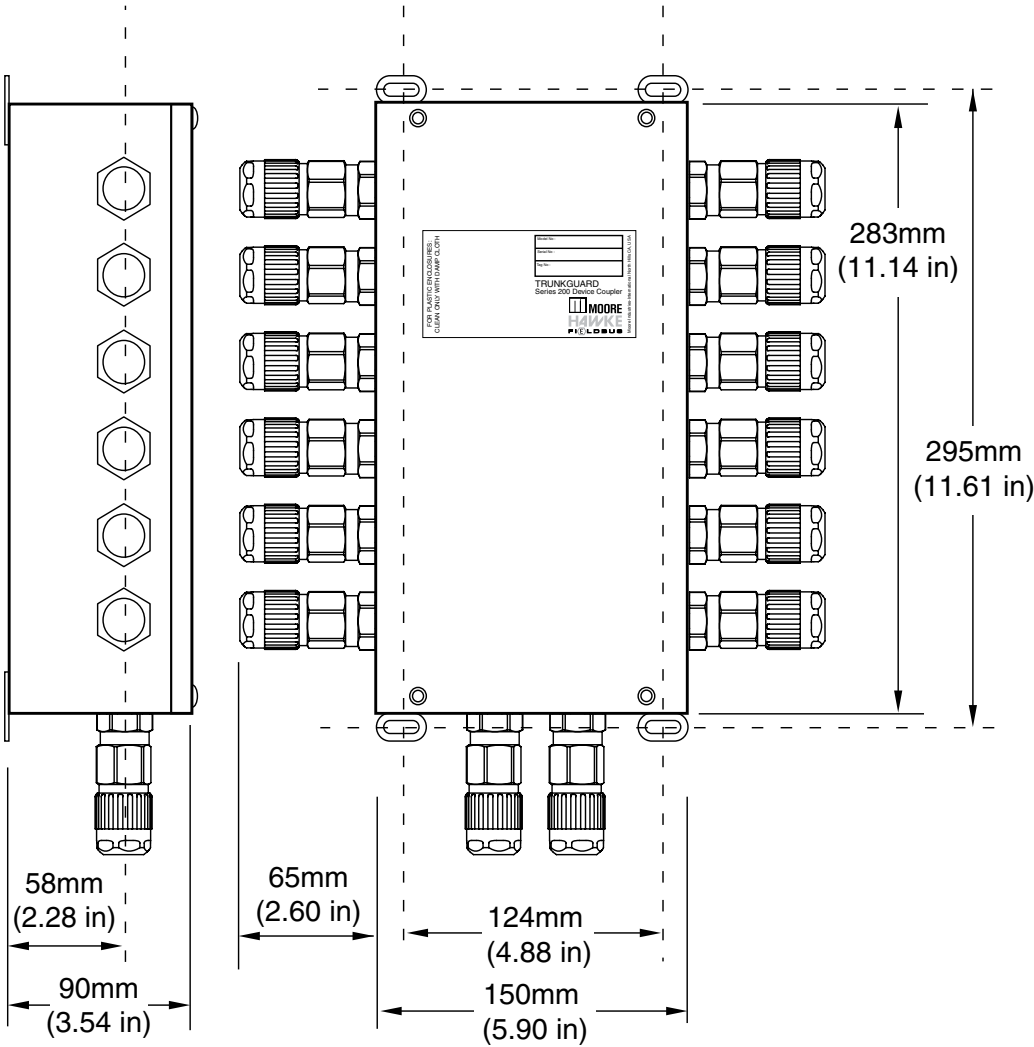
Figure 5. GRP (Glass Reinforced Polyester) Enclosure Installation Dimensions for 6-Spur (TS236) Models



TS Series

TRUNKSAFE® Fault Tolerant
Fieldbus System

Figure 6. Electro-Polished Stainless Steel 316 Enclosure Installation for 8-Spur, 10-Spur and 12-Spur Device Couplers. 12-Spur shown.



Installation

TPS201-4 DIN Carrier Units

DIN Carrier Units fit onto 32mm (EN50035) G-type and 35mm (EN50022) Top Hat DIN-rails. They should be mounted in a way to allow easy access to terminal receptacles and to keep LEDs visible. Horizontal DIN-rails are preferred so that air can flow vertically between the Conditioners to assist in module cooling.

An outdoor location requires an external enclosure. Any enclosure meeting the requirements of the location in relation to electrical and mechanical safety can be used (a minimum of IP54 is recommended). Contact MooreHawke for specific advice regarding installation of TPS201 DIN Carriers in any hazardous area.

TPS202 Advanced Power Conditioner

Advanced Power Conditioners fit onto sockets on the Carrier face. They only mount in one orientation and should be secured to the Carrier using the on-board screws. For shipping purposes, a jumper is fitted to each socket. It must be removed prior to module installation. Should a Power Conditioner be removed, the Fieldbus Diagnostics Module will indicate an alarm.

FDM252 Fieldbus Diagnostics Module

Fieldbus Diagnostics Modules fit onto sockets on the Carrier face. They only mount in one orientation. Use the on-board screws to secure the module to the Carrier.

FDM252 Alarms

There are multiple reasons that a Fieldbus Diagnostics Module may alarm. See Testing and Trouble Shooting Section of this Manual for details. These include an error within your system.

Jumpers

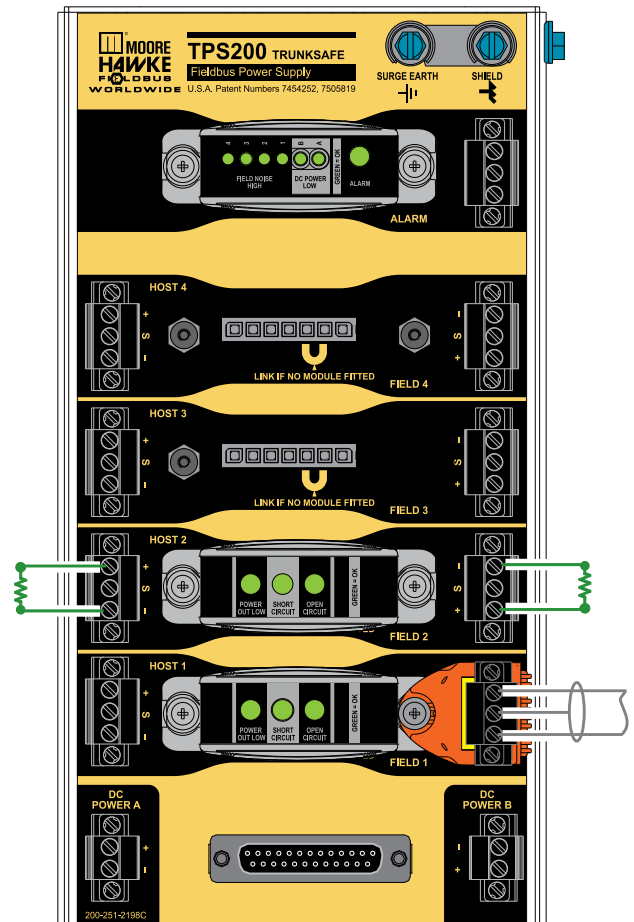
The TPS201 Carrier Module is shipped with jumpers fitted into the appropriate unused power slots (as marked). These jumpers must be placed (or retained) in any unused slot once the Carrier is used in an application, or else the alarm will be set on the Fieldbus Diagnostics Module. Extra jumpers are supplied in the TRUNKSAFE Kit, P/N: 208-265-00.

Resistors

Additionally, since the TPS202 continually monitors for open or short connections, if a TPS202 module is installed on the Carrier and is not being used in the system, the resistors provided (3.3kohm, 1W) in the TRUNKSAFE Kit, P/N: 208-265-00, must be placed on the Field and Host sides (at the + and – terminals not required on the Host side if DB25 cable is used and Interface/ Redundant adapter is connected) of that segment to prevent the Fieldbus Diagnostics Module from alarming. Resistors must be removed when the Trunk cables and Host wiring is added.

Resistors must also be placed on the field and Host side terminals for bench test purposes.

Figure 7. Example of Jumper and Resistor Placement



TS Series

TRUNKSAFE® Fault Tolerant
Fieldbus System

SPM201 Surge Protection Module

Surge Protection Modules (optional component) fit onto the field-side pluggable socket on the DIN Carrier face and accept the field-side pluggable terminals. They only mount in one orientation. A long screw is provided to secure the unit to the Carrier. This replaces the screw that is used to fasten the Advanced Power Conditioner modules to the Carrier face. It **must** be fitted in order to complete the ground connection of the Surge Protection Module.

TS200 Series Device Couplers

Device Couplers are typically located in the field. The TS200-DIN is supplied by MooreHawke for installation within a user-selected protective enclosure. Field-mounting enclosures along with cable glands/sockets can be ordered through MooreHawke. Refer to the TS Series data sheet for available enclosures.

Device Coupler location should be selected in order to allow easy access for field wiring but also to provide protection from mechanical damage or product spillage.

The Device Coupler should be secured to a DIN-rail and protected from external factors with an enclosure meeting a minimum of IP54 and that adheres to the following:

1. The enclosure must be compliant with the requirements for Directive 94/9/EC, Category 3 G applications.
2. A minimum clearance of 1mm must be maintained between live parts and grounded metal.
3. If other electrical circuits are fitted into the enclosure, they must be approved for the hazardous area. See Control Drawing 100-100-79 for further enclosure requirements.

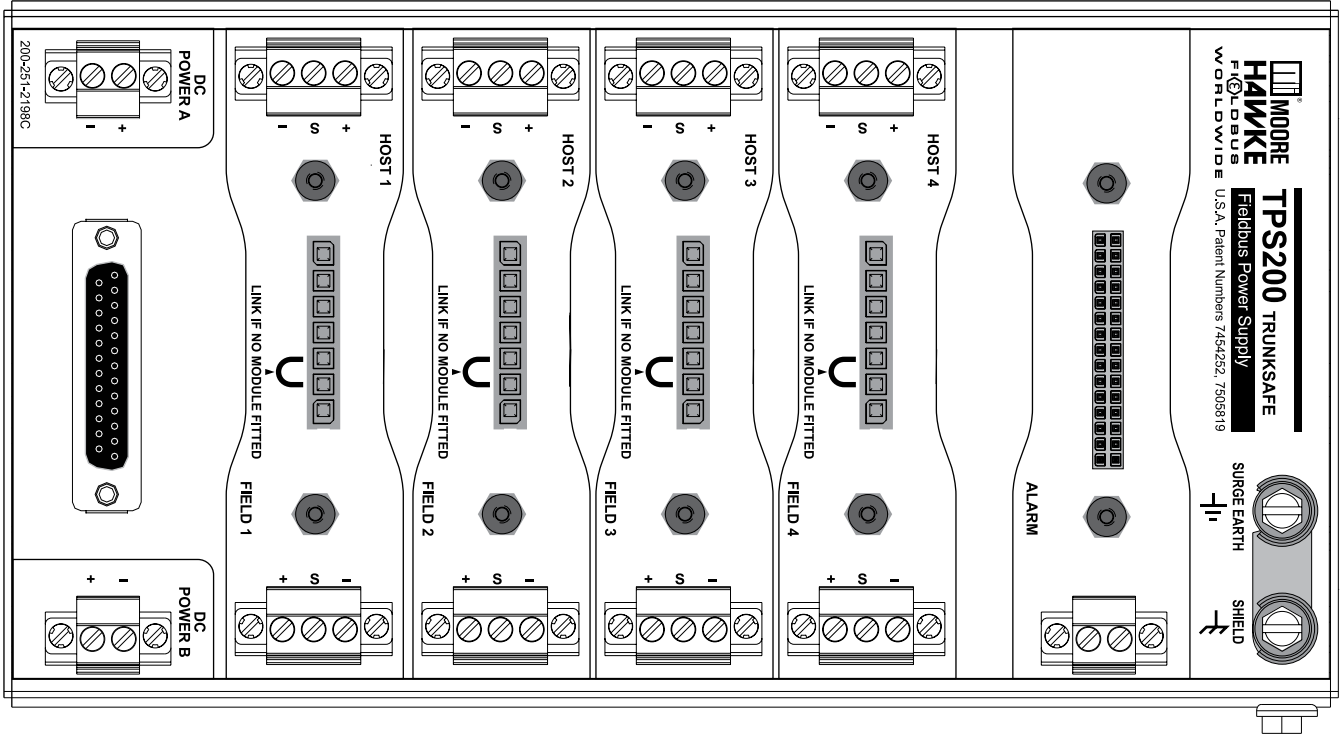
TS200 Series Device Couplers with MooreHawke-supplied external enclosures should be mounted to vertical surfaces in an orientation that prevents cable entry from above. Cables connected to all external enclosures should be oriented to prevent water running down the cable and into the enclosure entry. Cables approaching from above should continue down past the Device Coupler for at least 250mm (10 in), and then return upwards to the cable entry. Cables should be externally supported within 250mm (10 in) of the cable entry itself, particularly if armored cable is used. All unused cable entries should be sealed (MooreHawke-supplied enclosures with cable glands incorporate IP66 seals on all entries as standard).

Installation in third-party enclosures (not supplied by MooreHawke) and in hazardous locations should meet the requirements and appropriate approvals of that particular location.

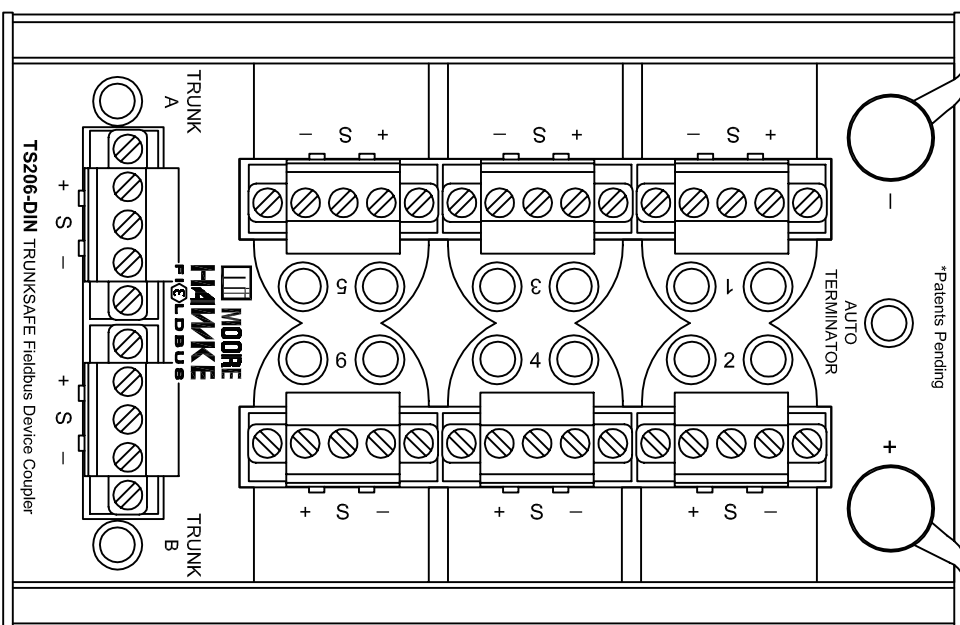
Please refer to TS200 ATEX and IECEx Certification section for more details.

Terminal Designations

TPS200



TS206 6-way shown below or TS20W 12-way



TS Series

TRUNKSAFE® Fault Tolerant
Fieldbus System

Wiring Connections

Each segment requires two independent field cables (typically called Trunk A and Trunk B). For maximum availability, each should have separate routing through the field until they meet at the TS200 Device Coupler. There is no need to balance the length of these two components, but the total length of all cables in any segment cannot exceed 1900m.

Any cable suitable for FOUNDATION fieldbus / PROFIBUS PA applications may be used. This is typically 18-22 AWG (0.8-1.5mm² cross-sectional area) cable with individual shields (normally called Type A cable). Components from multiple segments may be combined within a multi-core cable. If used, a separate multi-core shielded cable is required for both Trunk A and Trunk B cables. This is recommended in order to maintain separation of wiring. It is also recommended that various component shields remain independent of each other within the multi-core cable.

Wire terminations should be made from cables stripped to expose no more than 8mm (0.3 in) of conductor and inserted fully into the terminal opening. Bootlace ferrules are recommended for use with stranded cable. Field-side segment wiring is made via screw-clamp pluggable terminals marked FIELD. HOST connections are made either through the terminals marked HOST or via multi-way cables plugged directly to the header on the TPS201-4 Carrier board.

Nominal 24Vdc (19.2-32Vdc) power is required for terminals marked DC Power. Provisions are made for two independent DC feeds to the Carrier.

Note:

If only one DC power feed is to be used, a pair of jumper wires is required to the second set of DC feed terminals to ensure that the alarm monitoring circuit within the FDM252 (optional component) operates correctly.

At the TS200 Series Device Coupler, Trunk A and Trunk B are brought together and each Trunk is connected to one of the Trunk IN ports. The TS200 Series Device Coupler has a number of spur ports for the connection of field devices, depending on model. Wire terminations from field devices, including shield/screen wiring, should be made (as described above) into the appropriate screw-clamp pluggable terminal. Only one field device should be connected per spur.

WARNING:

For -ATEX units used in Zone 2 applications: Only the pluggable connectors supplied with the unit can be used for spur connections. This ensures that spurs cannot be plugged into the trunk sockets.

Caution:

It is recommended that the shield from field devices NOT be connected to the field device case.

Once all wiring connections have been made, all retaining screws on each module should be securely fastened and any external enclosure closed (where applicable).

Terminator

In the TRUNKSAFE system, each trunk is terminated by a 100 ohm resistor in series with a 1uF capacitor, hard-wired at each Advanced Power Conditioner position. No terminator is required at the HOST H1 interface. Contact MooreHawke if the HOST link cable is in excess of 30m (100ft).

In normal operation the segment is “terminated” at each of the power conditioners. The terminator in the field based device coupler is only activated in the event of a fault (i.e., cable break, short, etc).

Grounding

The TPS200 carrier is provided with three independent connection points relating to ground. This section provides details of each connection point and provides recommendations on connecting these grounds.

Case Ground

The CASE ground connection is for personnel protection and should be connected to the local structural ground in the panel or enclosure, typically the incoming ac power ground, if available. The case can also be grounded via the DIN rail.

Shield Ground

The SHIELD ground is the collection point for all of the shields relating to the fieldbus signals (both field- and HOST-side). This may be directly connected to ground, through a capacitor or via the HOST ground.

Note:

If capacitor is not used, only one SHIELD ground is needed either at the power carrier or at the HOST top end. However, if it is at the power carrier, then connect SHIELD point to GROUND.

Surge Ground

The SURGE ground is available for those installations that use the SPM201 surge protection modules.

These are designed to divert very large/short duration currents associated with surges (up to 20kA) and so these should not be connected to the normal SHIELD ground. When used for surge protection, the shorting bar between these ground points must be removed. Therefore, if no surge protection is being used, this shorting bar must be always connected to ground.

TS200 device coupler

The device coupler case should be grounded via the DIN rail.

Recommended Ground Wiring Practices

Moore Industries recommends the following ground wiring practices:

- Any MooreHawke product in a metal case or housing should be grounded.
- The protective earth conductor must be connected to a system safety earth ground before making any other connections.
- The maximum length of unshielded input and output signal wiring should be 2 inches.
- Some local electrical codes or facility practices may require the Shield to be connected to Ground at more than one location. Follow proper local guidelines.

Fieldbus cable shields are “carried through” the Carrier’s input/output terminals and require a suitable, noise-free ground connection point. The selected point is generally the HOST power or I/O ground rail.

If SPM201 Surge Protection Units are fitted, their securing screw must be installed per unit and the TPS201-4 DIN Carrier must be connected to a low impedance surge protection ground with a direct cable of at least 10 AWG (10mm² cross-sectional area) from the grounding lug provided.

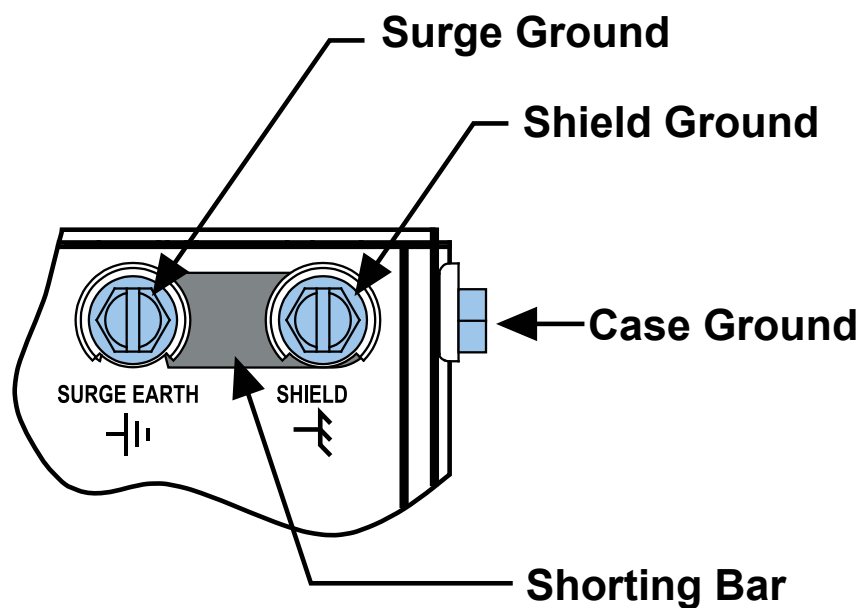
TS Series

TRUNSAFE® Fault Tolerant
Fieldbus System

CE Conformity

Installation of any Moore Industries' products that carry CE certification (Commission Electrotechnique) **must** adhere to the guidelines in *Recommended Ground Wiring Practices* in order to meet the requirements set forth in applicable EMC (Electromagnetic Compatibility) directives 2004/108/EC, EN 61326. Consult the factory for the most current information on products that have been CE certified.

Figure 8. Grounding options



Testing and Troubleshooting

Refer to Table 1 for information on LED indications of fault conditions.

If the HOST cables are not connected to the HOST, or if Advanced Power Conditioners are installed and powered but with no device coupler connected, the Fieldbus Diagnostics Module will display a constant alarm. This alarm can be suppressed by installing load resistors (3.3kohm, 1W) into the pluggable terminals during commissioning.

Note that the DIN Carrier has a link fitted at each Power Conditioner position. The link must be removed prior to installation and must be replaced should a Power Conditioner be removed.

LED Operation

During normal operation, LED sequence should be as follows:

TPS202 Advanced Power Conditioners: All LEDs should be GREEN.

Note:

An open-circuit on the TPS202 can occur on the HOST or the field side of the segment. To determine which side is open, measure the voltage on the FIELD side connector. If the measured voltage is null, then the open circuit is on the field side. Alternatively, if voltage is present, then the open circuit is on the HOST side.

FDM252 Diagnostics Modules: All LEDs should be GREEN.

TS200 Series Device Coupler: All Spur LEDs should be GREEN.

If any RED LED is ON, or any GREEN LED is OFF, refer to Table 1 for troubleshooting tips.

In normal operation the Auto Terminator led will be off. It will only be on (YELLOW) if there is a Trunk failure (i.e., cable break, short, etc).

Figure 9. Module LED Indicators

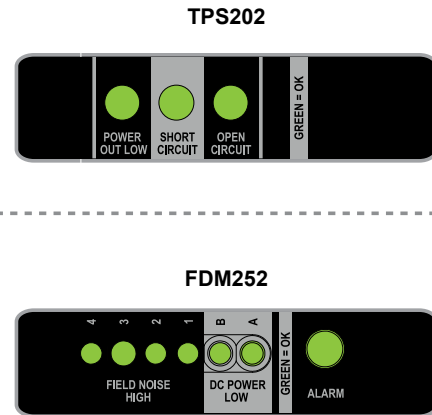


Table 1. Troubleshooting

TPS202 Advanced Power Conditioner

LED	LED Indication		
POWER OUT LOW	GREEN	Amber	OFF
	Normal Operation	Output Voltage < 18V	Module failure
SHORT CIRCUIT	GREEN	RED	OFF
	Normal Operation	Cable short-circuit	Module failure
OPEN CIRCUIT	GREEN	RED	OFF
	Normal Operation	Cable open-circuit	Module failure

FDM252 Fieldbus Diagnostic Module

LED	LED Indication		
DC01	GREEN	RED	OFF
	Normal Operation	Input Voltage 1 < 18V	Module failure
DC02	GREEN	RED	OFF
	Normal Operation	Input Voltage 2 < 18V	Module failure
NOISE 1	GREEN	RED	OFF
	Normal Operation	Noise > 75mVp/p	Module failure
NOISE 2	GREEN	RED	OFF
	Normal Operation	Noise > 75mVp/p	Module failure
NOISE 3	GREEN	RED	OFF
	Normal Operation	Noise > 75mVp/p	Module failure
NOISE 4	GREEN	RED	OFF
	Normal Operation	Noise > 75mVp/p	Module failure

TS200-DIN Fieldbus Device Coupler

LED	LED Indication		
Trunk A	GREEN	N/A	OFF
	Normal Operation		**Loss of Power
Trunk B	GREEN	N/A	OFF
	Normal Operation		**Loss of Power
*Spur	GREEN	RED	OFF
	Normal Operation	Spur short-circuit	**Loss of Power
Auto Terminator	YELLOW	N/A	OFF
	Terminator ON		Terminator OFF

*Spur has two LEDs to indicate normal and fault conditions.
**Cable open- or short-circuit is due to loss of power.

TS Series

TRUNKSAFE® Fault Tolerant
Fieldbus System

TS200 ATEX and IECEx Certification

Special Conditions of Certification

The Model TS206 and Model TS2W Device Couplers shall be powered by the Moore Industries Model TP202 Power Supply.

When the TS200 device coupler is installed as Category 3 equipment, it shall be installed in an enclosure which maintains an ingress protection rating of IP54 and meets the enclosure requirements of EN60079-0 and EN60079-15 (IEC 60079-0 and IEC60079-15 for IECEx).

The outputs of the Model TS206 and Model TS20W Device Couplers are non-linear.

ATEX Zone 2 only:

Legacy systems installed prior to May 1st, 2013 may install replacement TS200 units with energy limited spurs using installation diagram on page 2 of 100-100-76.

All new ATEX Zone 2 installations or system expansions after May 1st 2013 must use intrinsically safe wiring for spur circuits per installation diagram 100-100-79.

Operation

Once configured, installed and supplied with the correct power, TRUNKSAFE begins to operate immediately.

Maintenance

Moore Industries suggests a quick check for terminal tightness and general unit condition every 6-8 months. Always adhere to any site requirements for programmed maintenance.

TPS200 Series modules contain no user-serviceable parts. Non-functioning units under warranty should be returned to Moore Industries for replacement or repair.

Due to the nature of materials used to manufacture the TPS200 Series Power Conditioners and TS200 Series Device Couplers the user/installer should exercise caution with regard to possible attack by aggressive substances in any specific installation.

Customer Support

If service assistance is ever required for an device in your application, refer to the back cover of this manual for the telephone numbers to Moore Industries' customer service department.

If possible, make a note of the model number of the unit before calling. For fastest assistance, have the following information available: serial number, the job number and purchase order number under which it was shipped.



DO NOT SCALE DRAWING

DRAWN	C. Whan	6/09
CHECKED	YG	6/09
ENGINEER	H. Elsayed	6/09
SCALE	NONE	

CONTROL DRAWING

TITLE
**Field Installation Diagram:
 TS200 Device Coupler
 - cFMus -**

DRAWING NUMBER
100-100-76 SHEET 1 OF 2

REVISED BY
ECO 16973 DATE BY
9/13 CW

REVISION
B APPROVAL
CB

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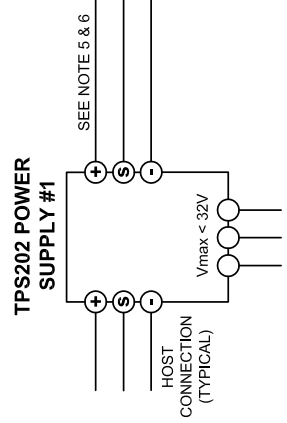
UNCLASSIFIED LOCATION

HAZARDOUS LOCATION

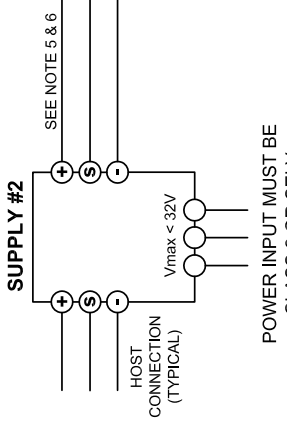
CLASS 1, DIVISION 2, GROUPS A, B, C & D
 -45°C < Ta < +70°C

INSTALLATION SHALL BE CARRIED OUT BY SUITABLY TRAINED PERSONNEL AND IN ACCORDANCE WITH NATIONAL ELECTRICAL CODE (ANSI/NFPA 70) OR CODES OF PRACTICE. USER REPAIR OF TS200 UNITS IS NOT POSSIBLE.
WARNING: SUBSTITUTION OF ANY COMPONENT MAY IMPAIR SUITABILITY FOR DIVISION 2.

TPS202 POWER SUPPLY #1



TPS202 POWER SUPPLY #2

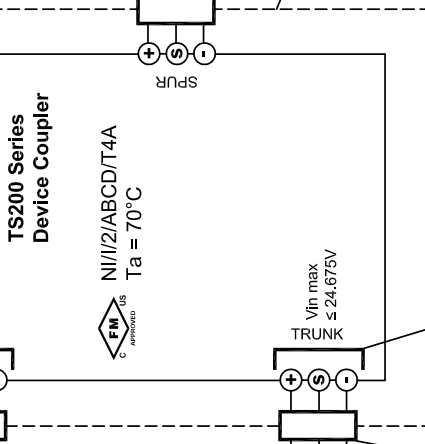


Spur Connections:

V_{oc} ≤ 24V ; for V_{in max} ≤ 24.675V
 I_o ≤ 150mA
 C_a = 150nF
 L_a = 6 mH

Non-Incendive Connections:

Spurs are Non-Incendive if cable parameters quoted are not exceeded. Non-Incendive Spurs may be disconnected and reconnected under power.



FIELDBUS DEVICE

Any FM (Entity) Approved Apparatus for Class 1 Division 2 Non-Incendive, Class 1 Division 1 Intrinsically Safe. Only 1 Device may be connected per Spur, using shielded single twisted pairs only, either as single shielded cables or within a multicore where each pair is shielded. Device maximum rated voltage and current must not be exceeded.

Field Wiring Notes:

1. No revision to drawing may be made without prior FM Approval.
2. The Non-Incendive Apparatus must be FM approved.
3. Associated Apparatus manufacturer's installation drawing must be followed when installing this equipment.
4. The Non-Incendive Field Wiring Concept allows interconnection of Non-Incendive Apparatus with Associated Apparatus not specifically examined in combination as a system when:
 $V_{max} \text{ OR } U_i > V_{oc}, V_i \text{ OR } U_o; C_a > C_i + C_{cable}; L_a > L_i + L_{cable}$
5. Installation in the U.S. should be in accordance with the National Electrical Code (ANSI/NFPA 70). Division 2 wiring method must be installed as per NEC.
6. Installation in Canada should be in accordance with the latest edition of the C22.1 Canadian Electrical Code, Part I.
7. Any external enclosure shall meet the requirements of ANS/ISA 61010-1.

TRUNK IN/OUT TERMINALS: MUST HAVE COVERS REPLACED BEFORE POWER IS APPLIED IN HAZARDOUS AREA

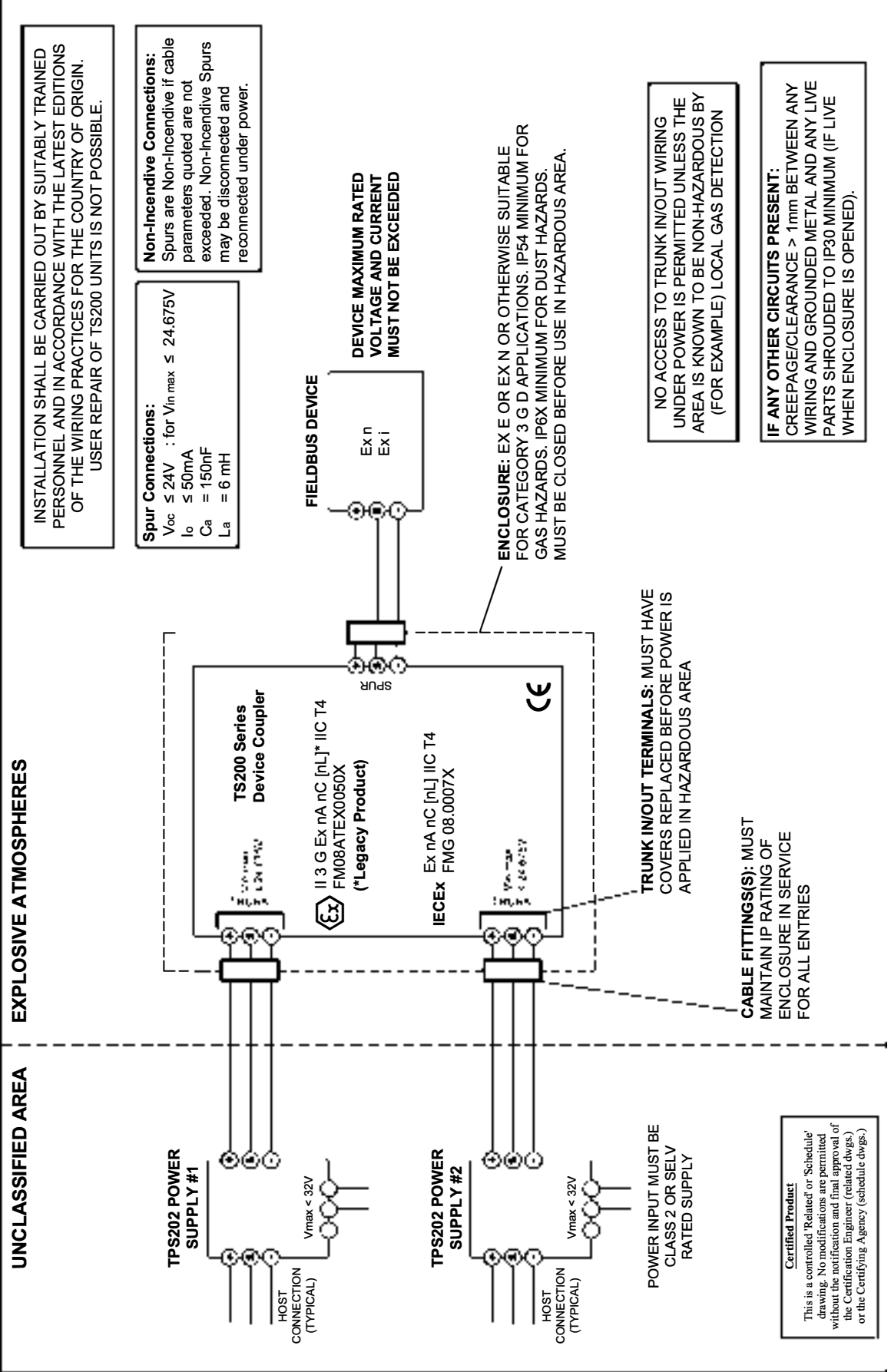
CABLE FITTINGS(S): MUST MAINTAIN IP RATING OF ENCLOSURE IN SERVICE FOR ALL ENTRIES

Certified Product
 This is a controlled 'Related' or 'Schedule' drawing. No modifications are permitted without the notification and final approval of the Certifying Engineer (related dwgs.) or the Certifying Agency (schedule dwgs.)

WARNING - EXPLOSION HAZARD
 DO NOT DISCONNECT AT TRUNK TERMINALS WHEN FLAMMABLE OR COMBUSTIBLE ATMOSPHERE IS PRESENT

MOORE INDUSTRIES	DO NOT SCALE DRAWING		CATEGORY CONTROL DRAWING	DRAWING NUMBER 100-100-76	SHEET 2 OF 2	REVISION B
	TOLERANCES (UNLESS NOTED) DECIMALS = ± inch/mm X .XX ±.01 / .254 .XXX ±.005 / 0.125 HOLES ±.003 / 0.080 ANGLES ±.1/2°	DRAWN C. Whan				
	CHECKED See Sht.1	ENGINEER See Sht.1	TITLE Field Installation Diagram: TS200 Device Coupler	REVISED BY SEE SHEET 1	DATE	APPROVAL
	SCALE NONE					

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DO NOT SCALE DRAWING

TOLERANCES (UNLESS NOTED)	DRAWN	9/13
DECIMALS = ±0.005 (mm)	CHECKED	9/13
X = ±0.1 (2.54)	ENGINEER	9/13
.XX = ±0.01 (0.25)	W. Tchan	
HOLES = ±0.03 (0.80)	SCALE	NONE
ANGLES = ±1/2°		

CATEGORY CONTROL DRAWING

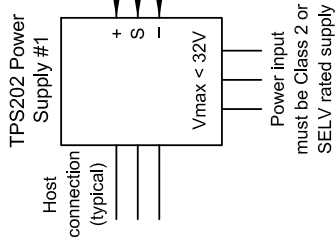
TITLE
**Installation Diagram:
 TS200-DIN-ATEX SERIES
 [ic] Zone 2**

DRAWING NUMBER
100-100-79

REVISION	APPROVAL
REVISED BY	DATE
ECO 16973	10/13
	BY
	CW
	APPROVAL
	CB

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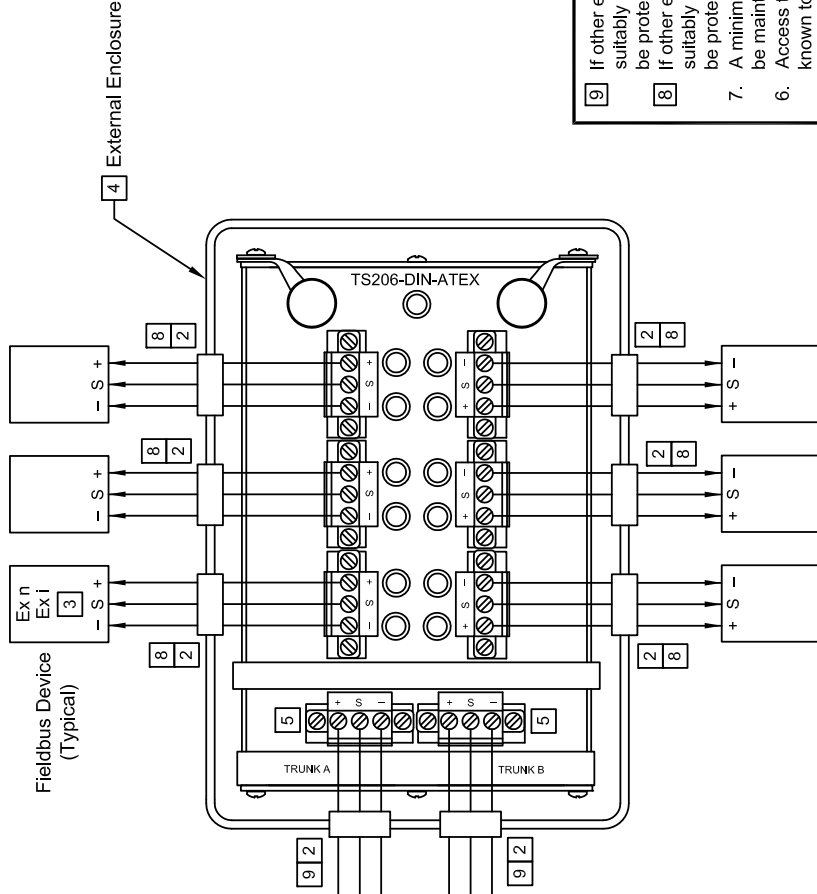
Non-Hazardous Area



Hazardous Area / Explosive Atmosphere

Ex II 3 G Ex nA nC [ic] IIC T4 (Zone 2)

-- WARNING --
 Substitution of components may impair Intrinsic Safety. To prevent ignition of flammable or combustible atmospheres, disconnect power before servicing.



Entity Parameters	
Spur Connections (+ S -)	Uo = 24Vdc Io = 50mA Co = 220nF Lo = 6mH
Operating Temperature Range:	-40°C ≤ Tamb. ≤ +70°C
Must use	+75°C suitable wiring

Installation may only be carried out by suitably trained personnel and in accordance with national wiring regulations or codes of practice.

Where English is not a language of the Country in which the equipment is being used, please apply to Moore Industries International, Inc. (MII) for a suitable translation.

Certified Product
 This is a controlled 'Related' or 'Schedule' drawing. No modifications are permitted without the notification and final approval of the Certification Engineer (related dwgs.) or the Certifying Agency (schedule dwgs.)

- 9 If other electrical circuits are fitted into the enclosure, then they shall be suitably approved for the hazardous area of installation and live parts shall be protected to a minimum of IP40 when the enclosure is opened.
- 8 If other electrical circuits are fitted into the enclosure, then they shall be suitably approved for the hazardous area of installation and live parts shall be protected to a minimum of IP20 when the enclosure is opened.
- 7 A minimum clearance of 1 mm between live parts and earthed metal shall be maintained.
- 6 Access to Trunk In wiring under power is NOT permitted unless the area is known to be Non-Hazardous.
- 5 Trunk In terminals must have covers replaced before power is applied in Hazardous Area.
- 4 External enclosure required. Must be suitable for Category 3 G applications, rated IP54 minimum and must be closed before use in Hazardous Area.
- 3 The device must be certified Ex n or Ex i and it's maximum rated voltage and current must NOT be exceeded.
- 2 Cable fittings must maintain IP rating of enclosure in service for all entries.
- 1 Installation shall be in accordance with the latest editions of the wiring practices for the country of origin and EN 60079-14.

Installation Notes:

HOST Interface Kits

The table below shows the interface adapters, redundant adapters, and cables needed for installation for your specific system. Refer to appendices for examples of system configurations.

Table. Moore Industries Interface options

	Emerson	Invensys	Yokogawa	Generic (ABB, SMAR, Rockwell, Honeywell)	Profibus
Kit Number	804-905-27	804-906-27	804-907-27	804-904-27	804-908-27
Cable (from Carrier to Interface Adapter)	Not required	2 x 804-011-26	804-009-26	2 x 804-009-26 804-013-26*	2 x 804-009-26
Interface Adapter	Not required	2 x 804-866-27	2 x 804-867-27	2 x 804-867-27	2 x 804-867-27
Redundant Adapter	2 x 804-858-27	804-864-27	804-869-27	804-861-27	804-868-27

* Use with Honeywell with alarm connections from Redundant Adapter to H1 Card.

TS Series

TRUNKSAFE® Fault Tolerant
Fieldbus System

Appendix A: TRUNKSAFE/ Emerson DeltaV System Configuration

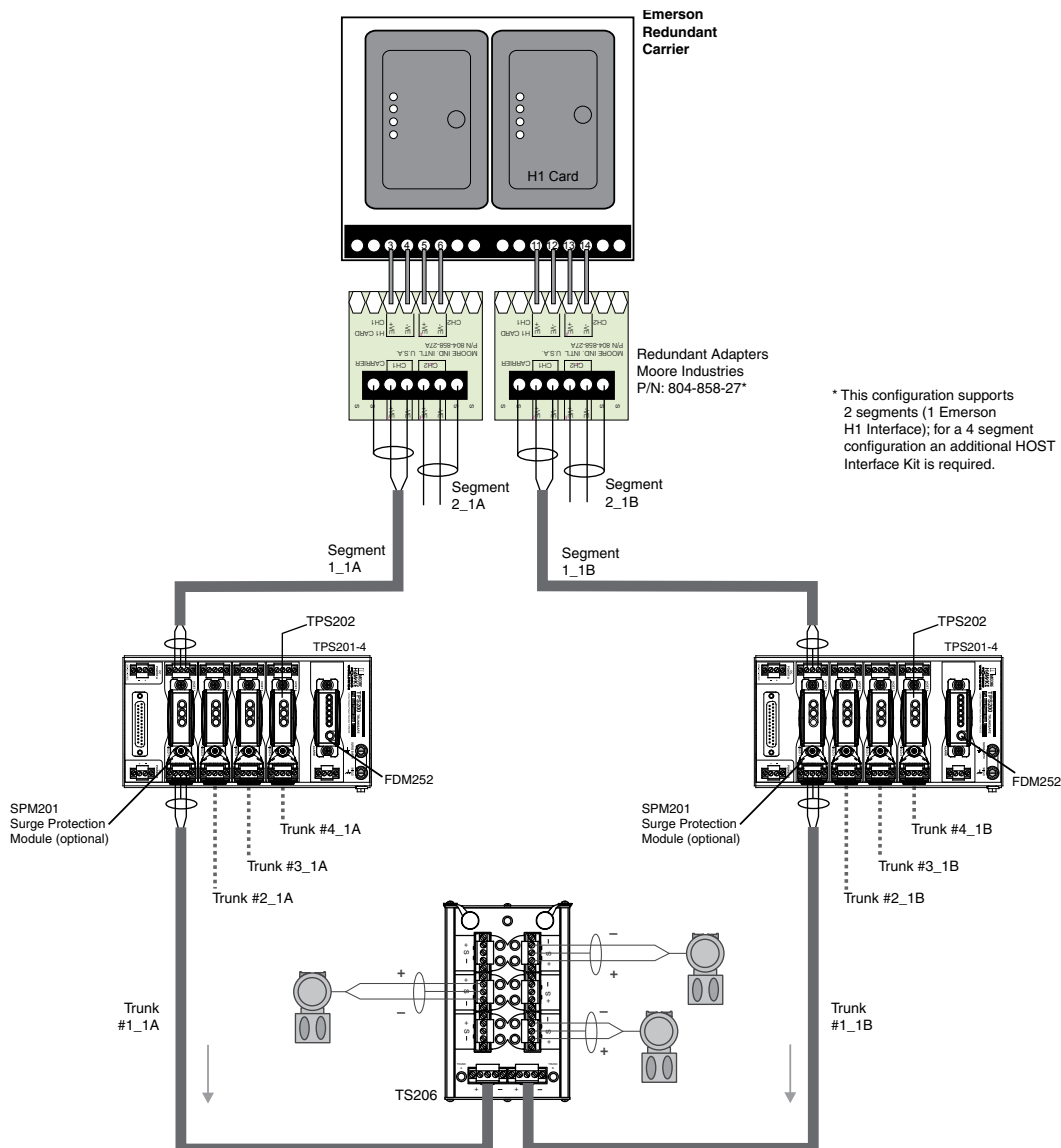
DeltaV is a digital automation system from Emerson Process Management. DeltaV incorporates FOUNDATION Fieldbus I/O capability via H1 cards. Redundant H1 cards are supported if using a DeltaV Series 6.0 or later which utilizes Series 2 H1 cards.

TRUNKSAFE can also be connected with the same HOST Interface Kit to the new S-Series H1 I/O cards (provided they do not have integrated power).

The redundant adaptor fits directly onto the Emerson Redundant Carrier terminals and makes independent terminals available for both redundant segments: Trunk1_1A, Trunk1_1B, Trunk 1_2A and Trunk 1_2B (refer to Figure A-2). This allows each trunk to be connected to the selected pair of TPS202 Advanced Power Conditioners, which may be on the same, or separate, TPS201-4 DIN Carriers, as required. Refer to Figure A-1 for an example of splitter operation.

To install TRUNKSAFE with an Emerson DeltaV system, refer to Figure A-1 below.

Figure A-1. TRUNKSAFE / Emerson DeltaV System Configuration



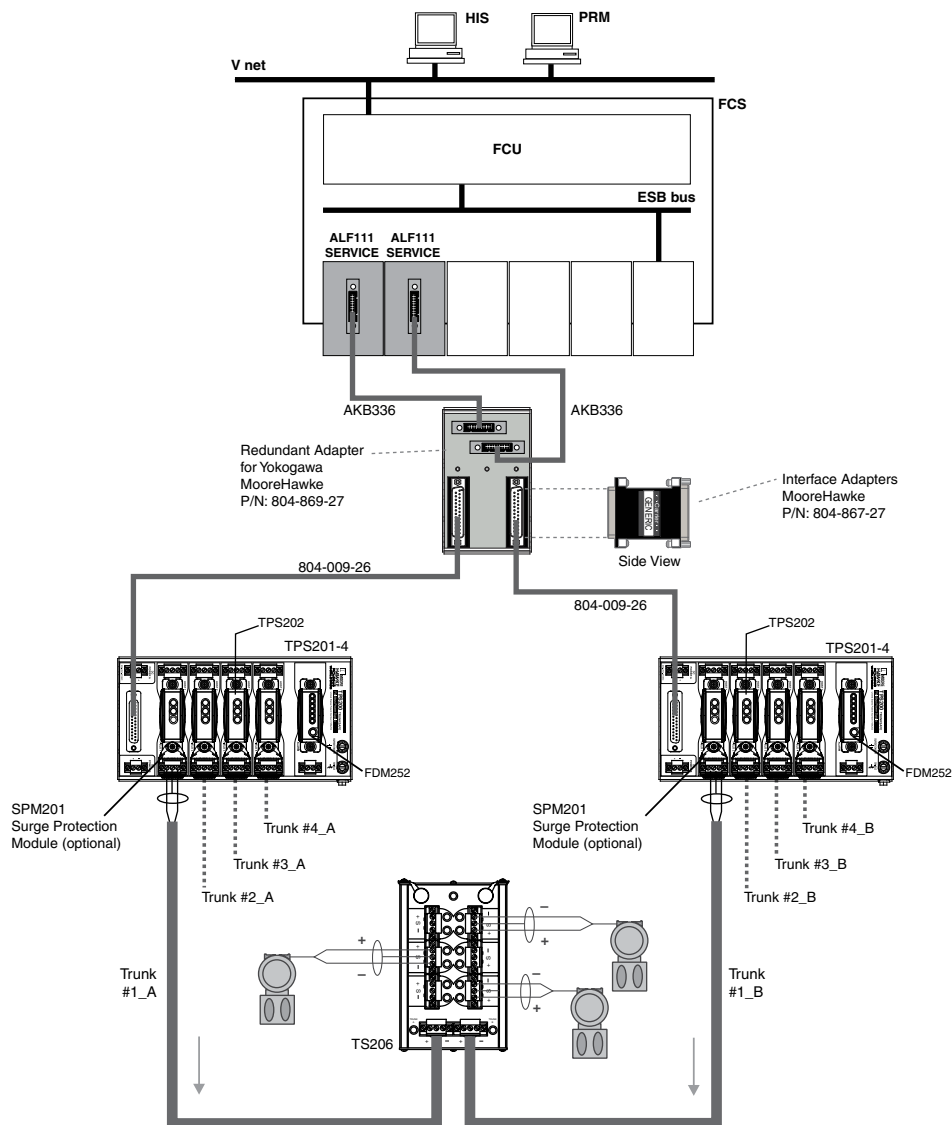
Appendix B: TRUNKSAFE / Yokogawa CENTUM System Configuration

Yokogawa CENTUM Systems can be connected using the 804-869-27 Redundancy Adapter. The connections between the ALF111 and the Redundancy Adapter are completed with the Yokogawa supplied AKB336 cables. The connections between the Redundancy Adapter and the TRUNKSAFE TPS201-4 are completed with

Moore Industries supplied DB25 cables, P/N 804-009-26. The standard length of the DB25 cables is six feet. Longer cable lengths can be provided upon special request. The maximum allowable length of each DB25 cable connection is 30 meters (~100 feet).

One DB25 (804-009-26) cable carries four segments from one ALF111 (1A, 2A, 3A, 4A) and the other DB25 (804-009-26) cable carries the other side of the redundant pair (1B, 2B, 3B, 4B) from the standby ALF111. Two TPS201-4 DIN Carriers then automatically support the 4 pairs of segment trunk cables. Refer to Figure A-2 for system configuration.

Figure A-2. TRUNKSAFE / Yokogawa CENTUM System Configuration



TS Series

TRUNKSAFE® Fault Tolerant
Fieldbus System

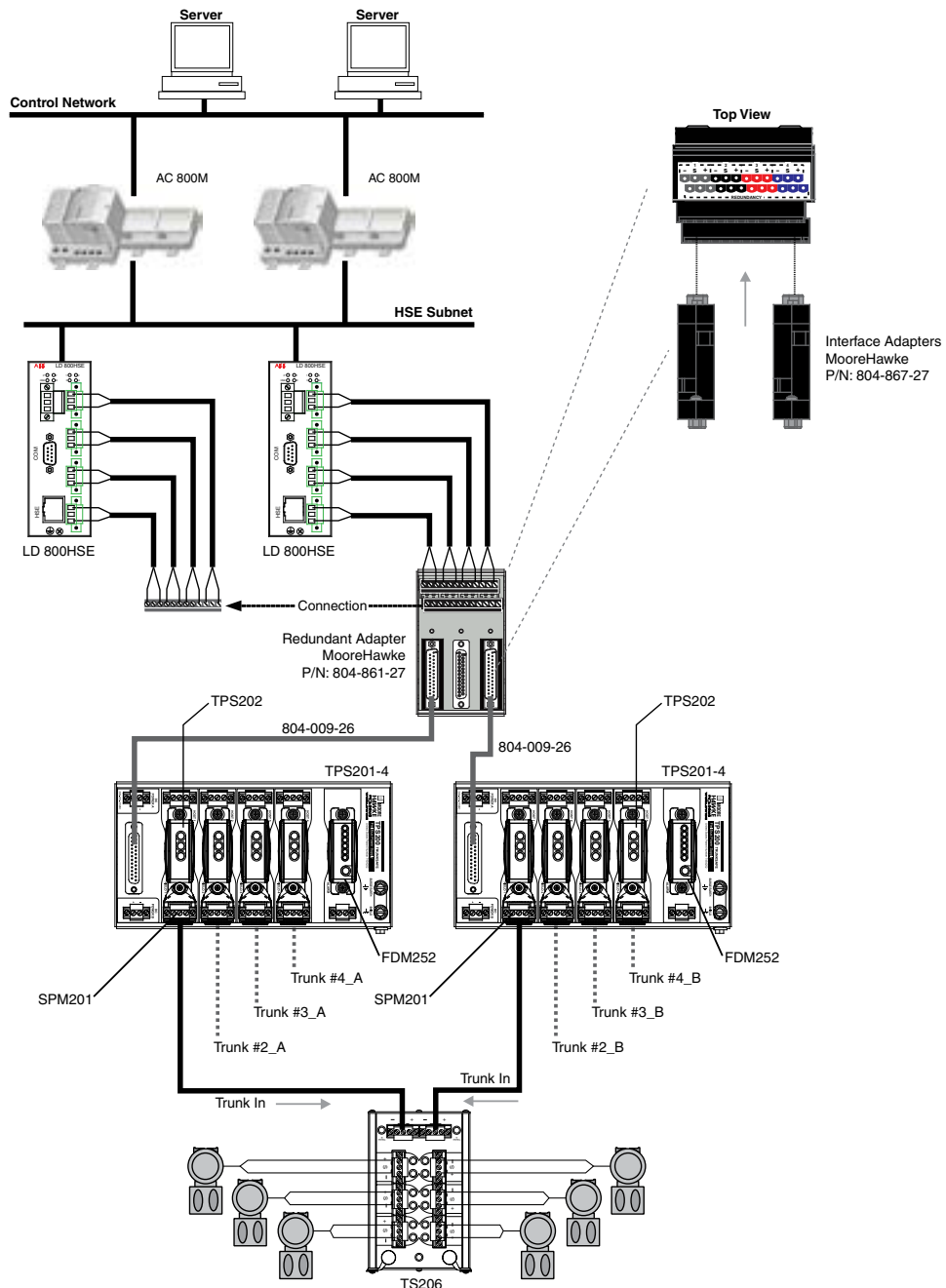
Appendix C: TRUNKSAFE/ ABB System 800 Configuration

TRUNKSAFE can be wired to each channel at the LD 800HSE linking device using 804-861-27

redundant adapter. Then connect the TPS201-4 to redundant adapter using 804-009-26 cable one per TRUNKSAFE unit.

Refer to Figure A-3 for installation instructions.

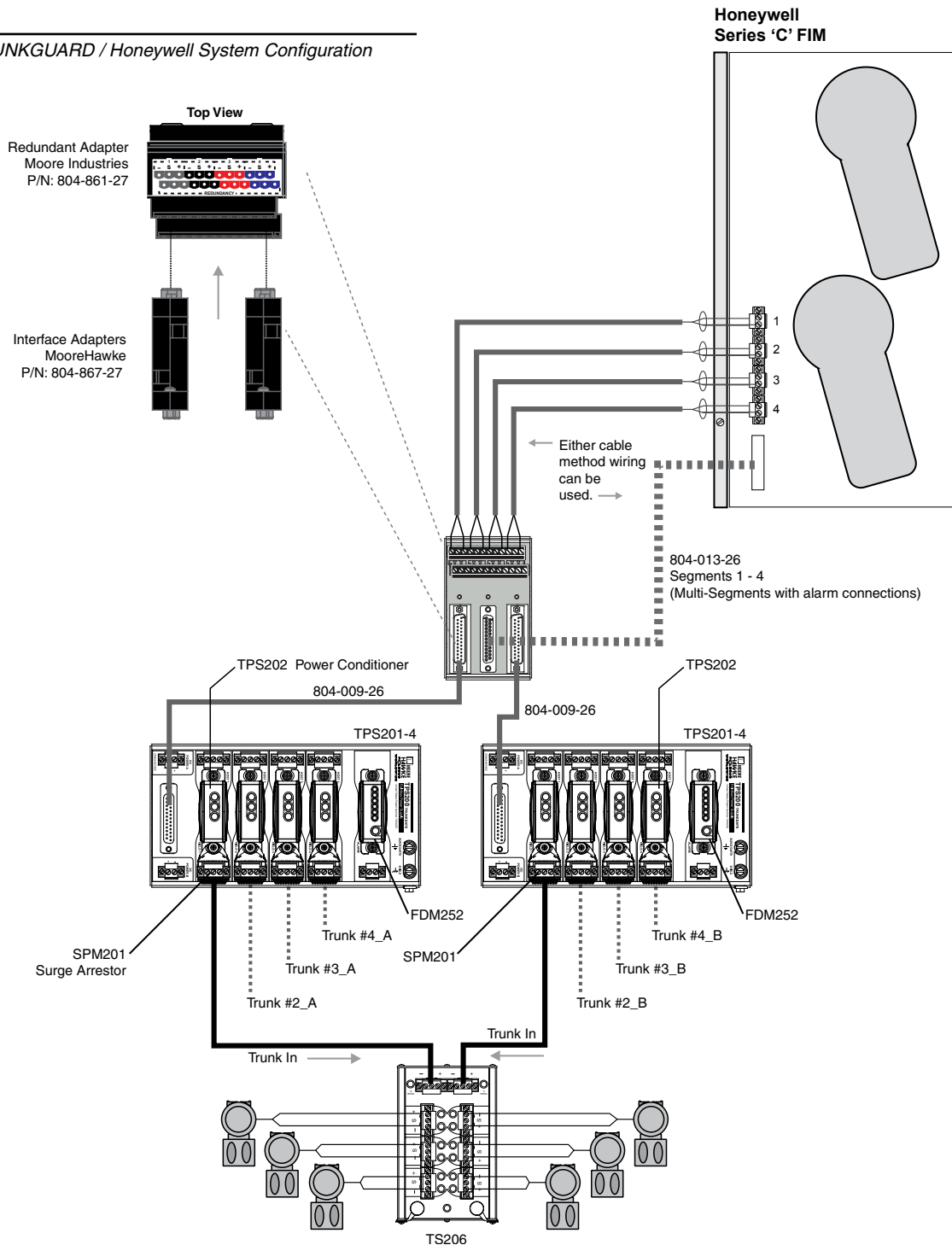
Figure A-3. TRUNKSAFE / ABB System 800 Configuration



Appendix D: TRUNKSAFE/ Honeywell System Configuration

To utilize TRUNKSAFE with a Honeywell system, refer to Figure A-4 below.

Figure A-4. TRUNKGUARD / Honeywell System Configuration



TS Series

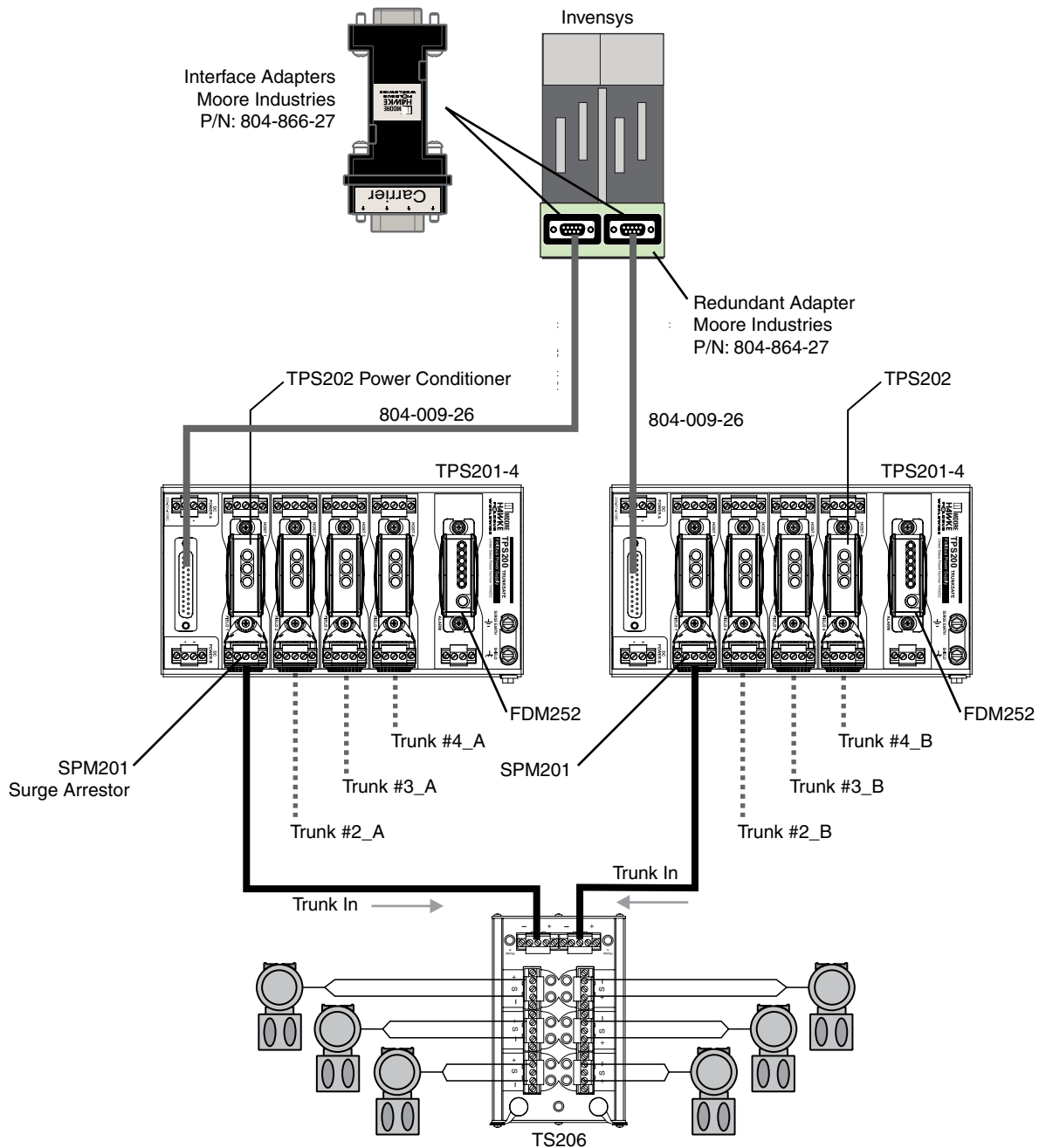
TRUNKSAFE® Fault Tolerant
Fieldbus System

Appendix E: TRUNKSAFE/ Invensys System Configuration

To utilize TRUNKSAFE with a Invensys system, refer to Figure A-5 below.

The Redundant adapter mounts directly on the I/A System carrier board. The interface adapters mount on the redundancy adapter and can be independently removed during operation. The interface adapter circuit is comprised of a passive diode network and series capacitors.

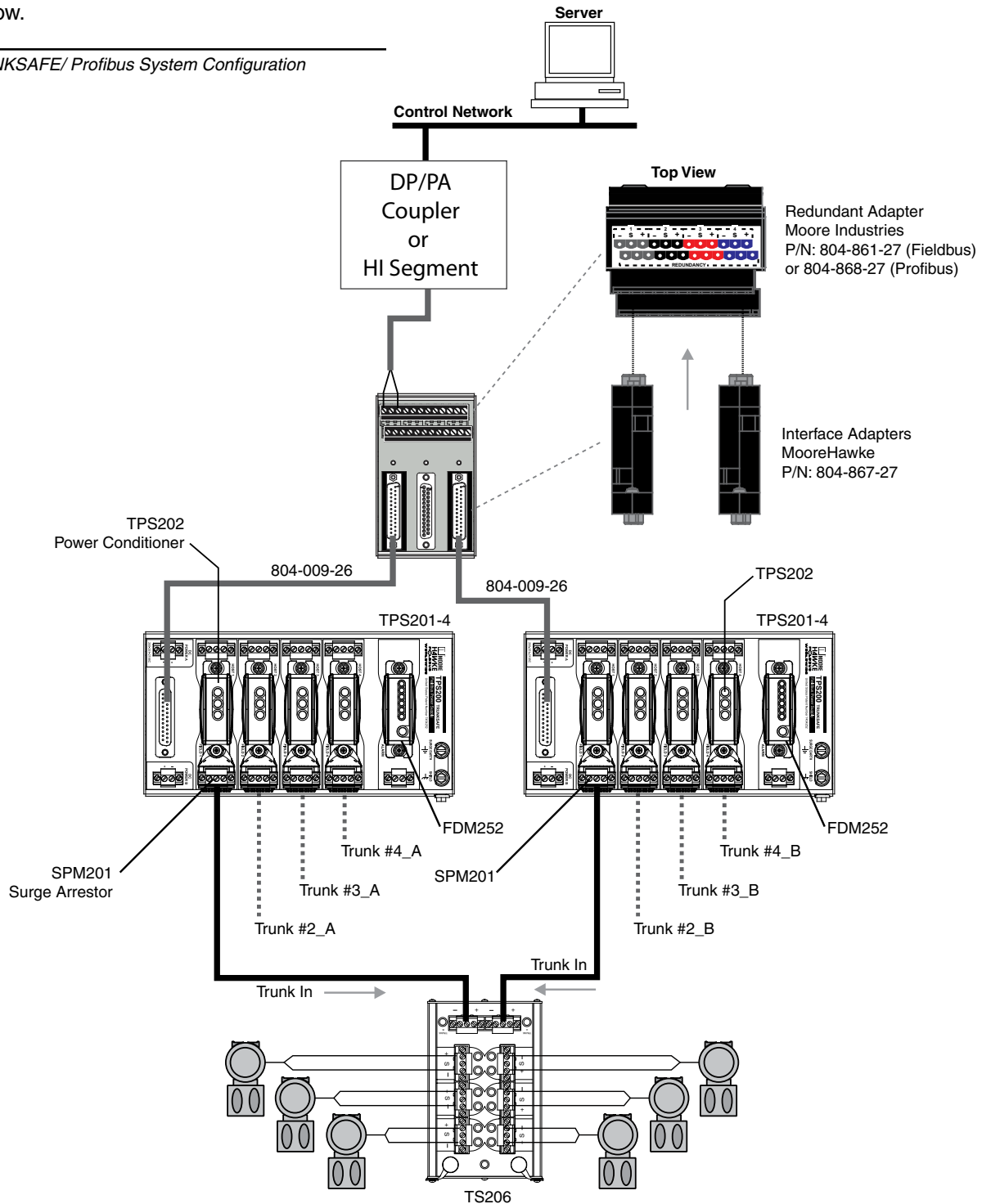
Figure A-5. TRUNKGUARD / Invensys System Configuration



Appendix F: TRUNKSAFE/ Profibus PA or any Host with non-redundant H1 Cards

To utilize TRUNKSAFE with a Profibus system, refer to Figure A-6 below.

Figure A-6. TRUNKSAFE/ Profibus System Configuration



RETURN PROCEDURES

To return equipment to Moore Industries for repair, follow these four steps:

1. Call Moore Industries and request a Returned Material Authorization (RMA) number.

Warranty Repair –

If you are unsure if your unit is still under warranty, we can use the unit's serial number to verify the warranty status for you over the phone. Be sure to include the RMA number on all documentation.

Non-Warranty Repair –

If your unit is out of warranty, be prepared to give us a Purchase Order number when you call. In most cases, we will be able to quote you the repair costs at that time. The repair price you are quoted will be a "Not To Exceed" price, which means that the actual repair costs may be less than the quote. Be sure to include the RMA number on all documentation.

2. Provide us with the following documentation:
 - a) A note listing the symptoms that indicate the unit needs repair
 - b) Complete shipping information for return of the equipment after repair
 - c) The name and phone number of the person to contact if questions arise at the factory
3. Use sufficient packing material and carefully pack the equipment in a sturdy shipping container.
4. Ship the equipment to the Moore Industries location nearest you.

The returned equipment will be inspected and tested at the factory. A Moore Industries representative will contact the person designated on your documentation if more information is needed. The repaired equipment, or its replacement, will be returned to you in accordance with the shipping instructions furnished in your documentation.

WARRANTY DISCLAIMER

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ANY BUYER OF GOODS OR SERVICES FROM THE COMPANY AGREES WITH THE COMPANY THAT THE SOLE AND EXCLUSIVE REMEDIES FOR BREACH OF ANY WARRANTY CONCERNING THE GOODS OR SERVICES SHALL BE FOR THE COMPANY, AT ITS OPTION, TO REPAIR OR REPLACE THE GOODS OR SERVICES OR REFUND THE PURCHASE PRICE. THE COMPANY SHALL IN NO EVENT BE LIABLE FOR ANY CONSEQUENTIAL OR INCIDENTAL DAMAGES EVEN IF THE COMPANY FAILS IN ANY ATTEMPT TO REMEDY DEFECTS IN THE GOODS OR SERVICES, BUT IN SUCH CASE THE BUYER SHALL BE ENTITLED TO NO MORE THAN A REFUND OF ALL MONIES PAID TO THE COMPANY BY THE BUYER FOR PURCHASE OF THE GOODS OR SERVICES.

ANY CAUSE OF ACTION FOR BREACH OF ANY WARRANTY BY THE COMPANY SHALL BE BARRED UNLESS THE COMPANY RECEIVES FROM THE BUYER A WRITTEN NOTICE OF THE ALLEGED DEFECT OR BREACH WITHIN TEN DAYS FROM THE EARLIEST DATE ON WHICH THE BUYER COULD REASONABLY HAVE DISCOVERED THE ALLEGED DEFECT OR BREACH, AND NO ACTION FOR THE BREACH OF ANY WARRANTY SHALL BE COMMENCED BY THE BUYER ANY LATER THAN TWELVE MONTHS FROM THE EARLIEST DATE ON WHICH THE BUYER COULD REASONABLY HAVE DISCOVERED THE ALLEGED DEFECT OR BREACH.

RETURN POLICY

For a period of thirty-six (36) months from the date of shipment, and under normal conditions of use and service, Moore Industries ("The Company") will at its option replace, repair or refund the purchase price for any of its manufactured products found, upon return to the Company (transportation charges prepaid and otherwise in accordance with the return procedures established by The Company), to be defective in material or workmanship. This policy extends to the original Buyer only and not to Buyer's customers or the users of Buyer's products, unless Buyer is an engineering contractor in which case the policy shall extend to Buyer's immediate customer only. This policy shall not apply if the product has been subject to alteration, misuse, accident, neglect or improper application, installation, or operation. THE COMPANY SHALL IN NO EVENT BE LIABLE FOR ANY INCIDENTAL OR CONSEQUENTIAL DAMAGES.



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