USER GUIDE

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MTS

Multivariable Trip Switch

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CE

NRTL/C

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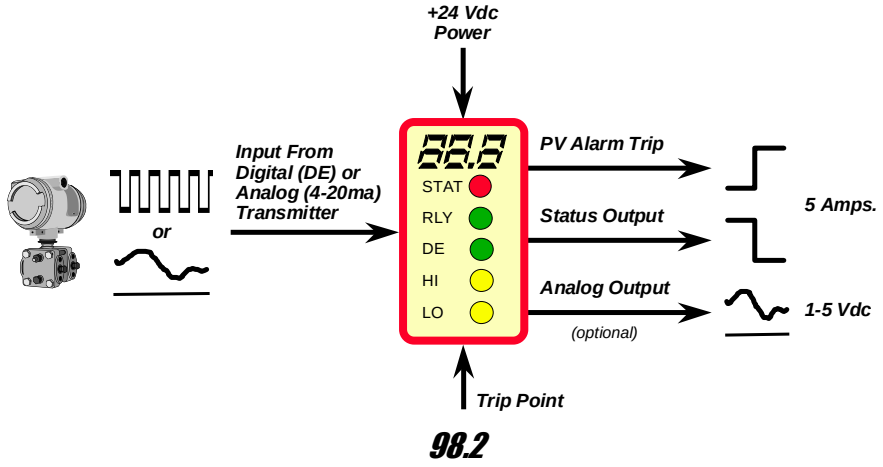
DESCRIPTION

The **Multivariable Trip Switch (MTS)** is a versatile stand-alone PV trip switch that can be used for On/Off Control, Safety Shutdown, Pressure Switch Replacement or Multivariable PV Alarming. The **MTS** works with all Honeywell *Smartline*™ Digitally Enhanced (DE) transmitters, 3rd party DE transmitters or any manufacturer's analog transmitter to provide a highly repeatable high or low PV trip. An analog output is optionally available to provide a means of interfacing a digital transmitter with analog instrumentation. The **MTS** is also fully compatible with all DE control system interfaces. In addition, handheld communicators may be used with **no** disturbances to the trip state, analog output or status.

Figure 1 - MTS Block Diagram



The **MTS** monitors a single transmitter's digital PV/SV or analog 4-20ma. signal and compares its value with the configured trip point. With a DE signal, **MTS** also provides an independent "smart status" output derived from the transmitter's diagnostic status. The module operates from a single +24VDC source, is internally short-circuit protected and suitable for DIN rail mounting.

DIGITAL INPUT versus ANALOG INPUT

Maximum flexibility is obtained when using the MTS with a *Digital* DE input. *Table 1* provides an overview of MTS capability for either a *Digital* DE or an *Analog* 4-20mA. transmitter signal. **For *analog* 4-20mA. or 1-5volt inputs the MTS INTERNAL LOOP RESISTOR MUST BE USED.** For a *digital* DE input there are no such restrictions.

Table 1 - Digital Input vs. Analog Input

	DIGITAL (DE)	**ANALOG** (4-20mA.) [1]
Trip Error	0	±1.0%
Resolution	16 bits	8 bits
Hysteresis	0.25%	2%
Response Time	25 msec.	60 msec.
Analog Repeat Out	YES	NO
MV Capability	YES	NO
Indep Xmtr Status	YES	YES [2]
SV Temp Capability	YES	NO
Bumpless Comm	YES	NO
Listener	YES	NO
Stand Alone	YES	YES

[1] *The MTS will also accept a 1-5 volt input provided the input signal is capable of driving the 250Ω load presented by the MTS.*

[2] *The status relay is activated when analog signal is outside 4-20mA. range.*

APPLICATIONS

TRANSMITTER MAINTENANCE ANNUNCIATION

The MTS *STATUS* Relay #1 is capable of providing an independent indication of transmitter status that is useful for annunciating a MAINTENANCE problem.

SAFETY SHUTDOWN APPLICATIONS

Process upsets or false shutdowns may be avoided by incorporating the transmitter/MTS status into the shutdown interlock strategy. With two(2) relays provided, relay #1 is user configurable as an independent status output, that is useful in differentiating a MAINTENANCE problem from a PROCESS problem. Alarm simplification is also possible when using the status output relay to eliminate the need for loop open/short trips. Shutdown reaction time may be improved by utilizing the status relay to validate the PV. If the *Analog Repeat* option is installed, the *Hold Last Know Good* feature may be enabled to allow the operator more time to react. Bumpless communications and configurable "output mode" action enhance validation procedures. MTS has taken into consideration the emerging requirements of ISA S84 IEC 61508.

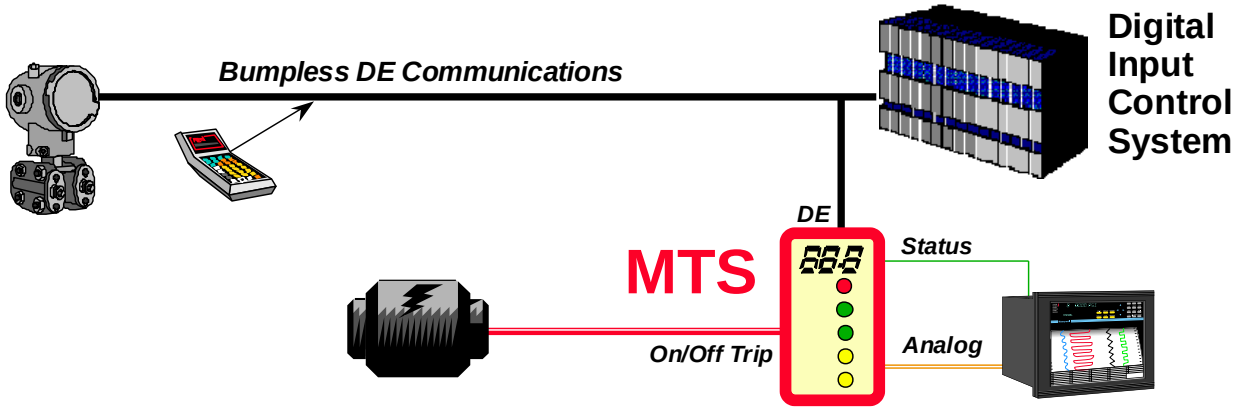


Figure 2 - Digital Input Control and Shutdown with Analog Monitor

MULTIVARIABLE ACCESS

The MTS is user configurable to access multivariable transmitters. A single **1-5volt** analog output of the selected variable is available with the *Analog Repeat* output option.

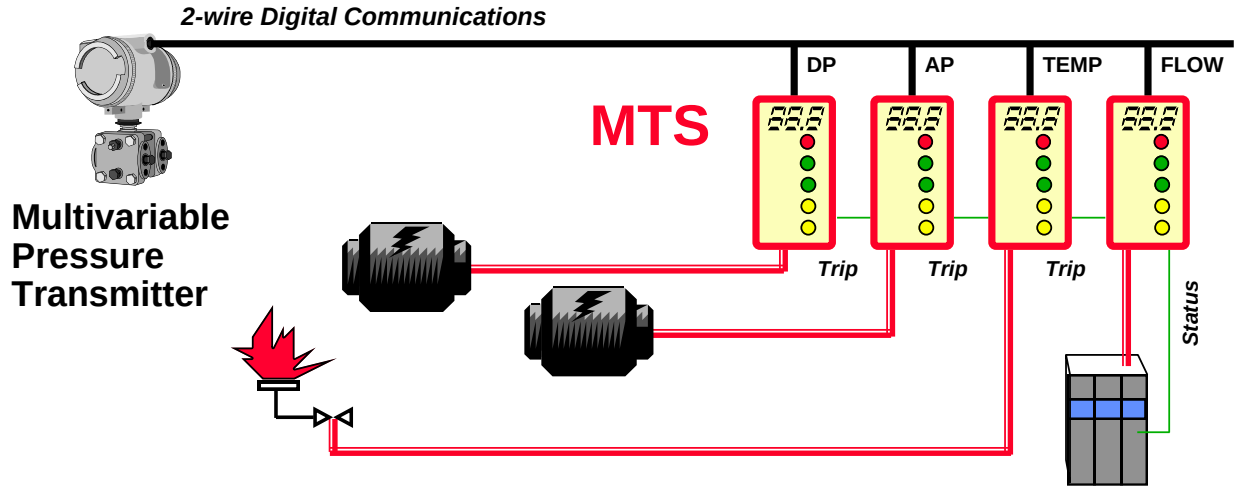


Figure 3 - Multidrop and Multivariable

ENHANCED ANALOG ACCURACY

With the *Analog Repeat* output option, the precision voltage output increases the overall analog accuracy 80% by eliminating errors introduced in the transmitter's D/A and the elimination of the 250 Ohm loop resistor. See *FREQUENTLY ASKED QUESTIONS* for details.

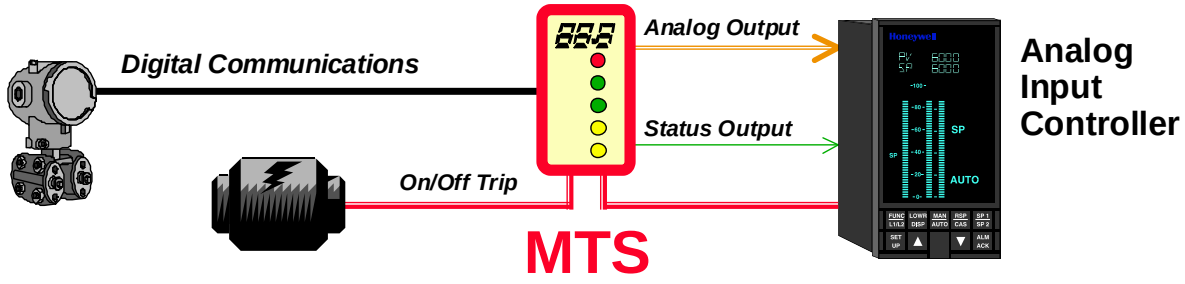


Figure 4 - Analog Input Control with Digital Shutdown

"SMART STATUS"

The MTS takes full advantage of DE transmitter diagnostic capabilities and MTS self-diagnostics by providing a single combined "Smart Status" indication. The "Smart Status" will take into consideration -

- Transmitter status (critical, non-critical, bad PV)
- Forced I/O manual mode (response action is user configurable)
- DE signal integrity (no DE, missing PV/SV)
- MTS test mode or module diagnostic fault

"Smart Status" will go BAD if ANY one of the above conditions are BAD. The MTS ***"STATUS"*** LED provides a visual indication. See *Table 6 - "STATUS" LED Description*. Also, Relay #1 trip action may be configured to trip on the "Smart Status" in addition to the PV trip point. See CONFIGURATION SWITCHES section for details.

INSTALLATION

MOUNTING

The MTS mounts on any 35 mm DIN rail (top hat, EN50022). The rails may be purchased in various heights, lengths and hole configurations. The MTS will mount on either shallow or deep rail types. The MTS may be mounted in any orientation without degradation of performance. As a *listener* device, the MTS may be installed without disconnecting or disrupting the existing installation.

ENVIRONMENTAL

The MTS is NOT suitable for harsh environments. It is intended to be mounted in rack room or control room environments. Refer to the specification for limits.

PRECAUTIONS

This CAUTION symbol on the equipment refers the user to the User Guide for additional information. This symbol appears next to required information in this manual.

For 4-20mA. or 1-5volt **analog inputs** the MTS INTERNAL LOOP RESISTOR MUST BE USED. It is good practice to also provide the loop power via the MTS but this is not a requirement. For a *digital* DE input there are no such restrictions.

If the *Analog Repeat* option is installed for digital PV (DE) inputs, the MTS should be installed in close proximity to the instrumentation that is receiving the analog output. Wire lengths to the analog instrumentation should be kept as short a possible. Wire runs as long as 50 feet may be tolerated provided the analog instrumentation has differential input capability. A separate analog signal return wire from the MTS should be provided which is not used to carry other return signals or power. Following these precautions will help maintain the rated accuracy of the MTS analog output. The WIRING DIAGRAMS section indicate alternative connections for improved performance in specific applications.

When using an **analog input** PV trip it is NOT RECOMMENDED that the *Analog Repeat* output option be utilized. This output is not isolated and would serve little useful purpose.

Precautions should be taken to avoid installation of the MTS in locations that may not be suitable for reliable operation. Refer to the SPECIFICATIONS section for electrical and environmental requirements.

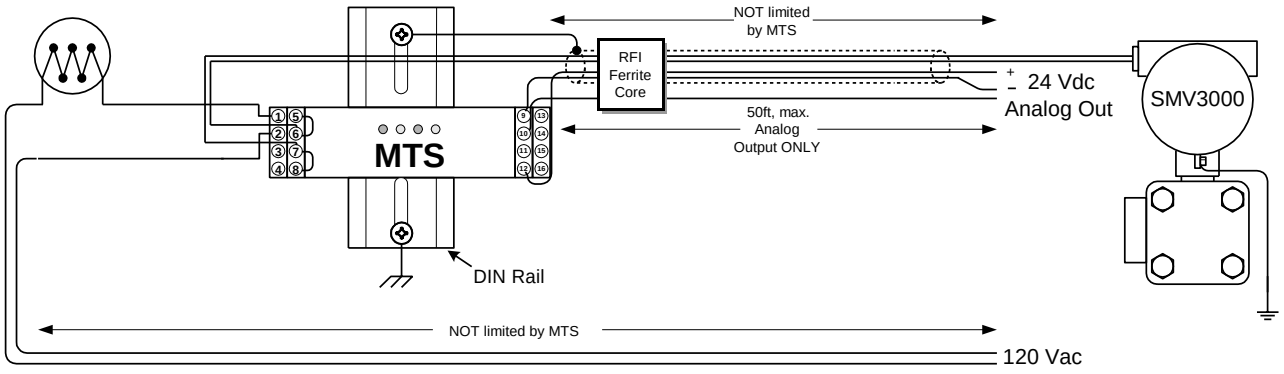
While the MTS is NOT isolated, the DE input is capacitively coupled and is relatively insensitive to noise since the signal is digital and can tolerate up to 50 VDC of common mode. Situations with greater potentials should install a commercial isolation module between the field instrument and the MTS.

CE CONFORMITY (European Option)

This product is in conformity with the protection requirements of the following European Council Directives: **73/23/EEC**, the Low Voltage Directive, and **89/336/EEC**, the EMC Directive. Conformity of this product with any other "CE Mark" Directive(s) shall not be assumed. Deviation from the installation conditions specified in this manual may invalidate this product's conformity with the Low Voltage and EMC Directives.

On models with the *Analog Repeat* option, A ferrite suppression filter, Fair-Rite # 0443164151 or Honeywell # 51197612 or equivalent, is required on all signal and 24VDC power cables, mounted as close to the MTS unit as possible. Shielded twisted pair cables, Belden # 9318 or equivalent, are required for all transmitter, analog output and 24VDC power. Shields shall be grounded at the MTS end only. Two suppression filters are provided because installations and wire type may vary. *Figure 5 - CE Mark Wiring*, depicts an installation using one ferrite suppression filter.

Figure 5 - CE Mark Wiring Example

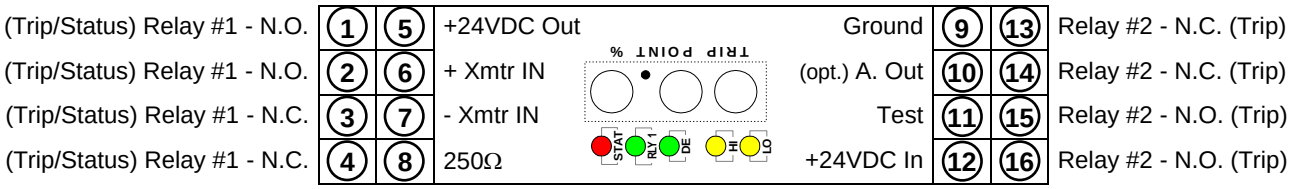


CONTROL and RELAY WIRING

The insulation of wires connected to the control and relay terminals shall be rated for the highest voltage involved. Extra Low Voltage (ELV) wiring (input, output) shall be separated from HAZARDOUS LIVE (>50 Vac, or 75 Vdc) Low Voltage (LV) Relay circuits.

All connectors are removable and keyed. The MTS will accept up to 12 awg. stranded wire. When terminating multiple wires under a single screw terminal it is good practice to use an external fastener. For ease of SFC or SCT connection, it may be useful to leave 1/8" of the wire exposed for connection of the clipleads. Refer to the detailed wiring diagram shown in the WIRING DIAGRAMS section.

Figure 6 - Terminal Numbering



NOTE: Relay #1 and #2 are normally energized for good transmitter status and no PV trip. Therefore, the N.O. relay contacts are CLOSED for normal operation with good transmitter status and no PV trip.

THE MTS Analog Output is 1-5 VOLTS (not 4-20ma.). DAMAGE WILL OCCUR TO THE MTS IF CONNECTED TO A CURRENT LOOP VOLTAGE SOURCE.

STAND ALONE versus LISTENER

When used as *STAND ALONE*, the MTS provides the loop power and 250Ω loop resistor. When used as *LISTENER*, the loop power and 250Ω loop resistor are provided externally (e.g. Host DCS, PLC, etc.). As a *LISTENER*, the MTS may be connected at any point along the loop between the transmitter and the 250Ω loop resistor provided environmental requirements are met.

USING MULTIPLE MTSs

For multiple PV trips, several MTS modules may be used to *listen* to a single field instrument since the MTS input impedance is 10Kohm. This may also be advantageous if the distances between instrumentation are large.

POWERING THE MTS

The MTS is intended to operate from a 24VDC bulk supply. The MTS Analog Repeat option uses a thermally stabilized device that requires approximately 250 mA for 2 seconds after power-up, after which the current draw is reduced to 80 mA.

POWERING THE FIELD INSTRUMENT

The field instrument can be optionally powered by the MTS via terminal 5. For a digital DE input signal, the MTS optionally provides a 250 ohm loop resistor via terminal 8. The MTS internal loop resistor MUST be used with analog inputs. The internal loop resistor is specially calibrated for the MTS and should not be used for any other purposes. The transmitter supply from the MTS is short circuit protected to 300 mA. and will automatically recover a few seconds after the short is removed.

WITH HOST (TPS/TDC, PLC, etc.)

When using the MTS with a host device, the field instrument is usually NOT powered by the MTS. The MTS behaves as a *listener* and must be wired such that the system safety barrier operation is not compromised.

WITH SAFETY BARRIERS

Only approved safety barriers which are capable of passing the digital DE signal may be used. Refer to the Honeywell PM/APM Smartline Transmitter Integration Manual, #PM12-410, or call Honeywell for assistance.

USE WITH MVA, SFC, SCT, METERS, STDC, STI-MV, ETC.

The MTS is compatible with all other DE devices. Up to ten (10) devices may be simultaneously connected to the digital DE loop at any point.

CONFIGURATION

MTS configuration is accomplished via three(3) rotary switches on the module top and one(1) row of internal DIP switches. All switches may be set using a fine blade screwdriver.

The internal switches are accessed by slightly depressing the two(2) tabs on each side of the module while gently sliding the module top upwards until the row of DIP switches are visible. See *Figure 7 - Configuration Switch Location*.

Using a small tool, slide the appropriate switch to the desired position. Refer to *Figure 10 - Configuration DIP Switch Layout* and *Table 3 - Configuration switch descriptions*. When all configuration is completed, slide the module top back down into the lower housing until both side tabs are engaged.

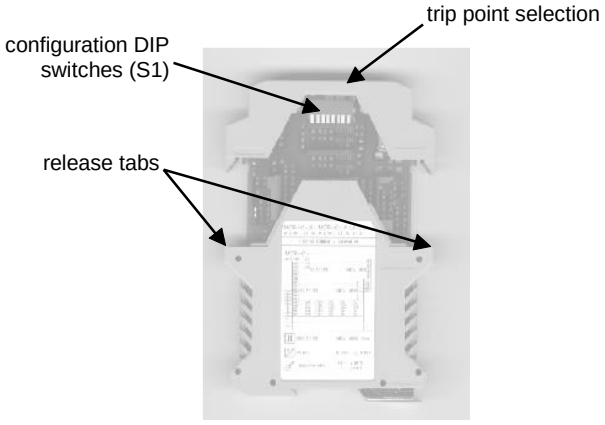


Figure 7 - Configuration Switch Location

Although it is recommended that the MTS be configured with all power off or connectors removed, the MTS may be configured "hot". In which case there may be a delay of up to 60 seconds for the new configuration information to be acquired from the transmitter.

PV TRIP POINT

The three(3) rotary switches on the module top are used to set the PV TRIP point, the value at which the MTS will TRIP. The range is from 0 to 99.9% in increments of 0.1%. Use a fine blade screwdriver to carefully rotate the switches. The TRIP DIRECTION (high/low) configuration is selected via the internal switches.

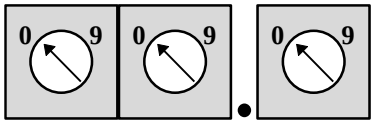


Figure 8 - PV Trip Point Switches

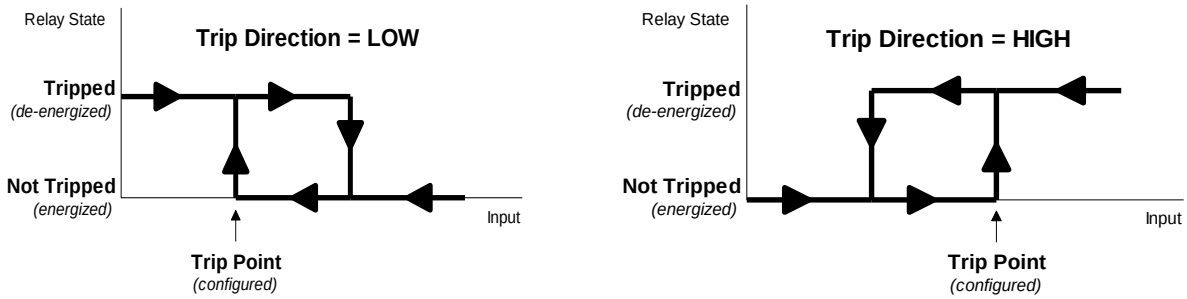
HYSTERESIS

The MTS has two(2) fixed hysteresis values that are pre-configured based on the configured PV/SV input type.

Table 2 - PV Trip hysteresis values

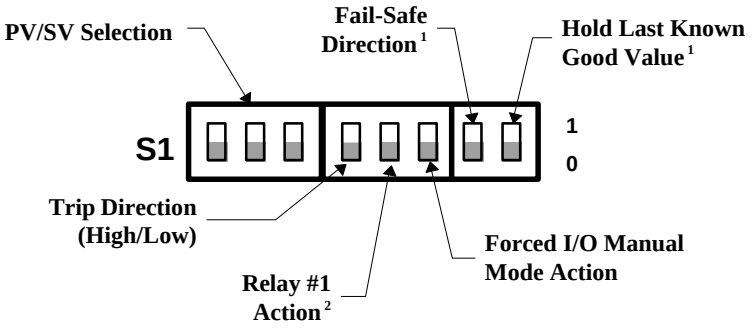
	Digital Input	Analog Input
HYSTERESIS	0.25%	2%

Figure 9 - Hysteresis Characteristics



CONFIGURATION SWITCHES

Figure 10 - Configuration DIP Switch Layout



Switches are shown in the factory default position.

[1] *Active only if the Analog Repeat option is* installed.
[2] *Active only on 2 relay models.*

Table 3 - Configuration switch descriptions

FUNCTION	SWITCH POSITION	ACTION	
PV/SV SELECTION	000	Digital PV1 *	0% - 100%
	001	Digital PV2	0% - 100%
	010	Digital PV3	0% - 100%
	011	Digital PV4	0% - 100%
	100	Digital SV1 - Full	-40ºC to +110ºC
	101	Digital SV1 - Narrow	0ºC to +100ºC
	110	Analog Volts	1-5volts
	111	Analog Current	4-20mA.
TRIP DIRECTION	0	HIGH *	PV/SV ≥ Trip Point
	1	LOW	PV/SV ≤ Trip Point
RELAY #1 ACTION	0	TRIP & STATUS *	
	1	STATUS Only	**[SEE NOTES]**
FORCED I/O MANUAL ACTION	0	TRIP *	(Relay #1 de-energized)
	1	NOT TRIP	(Relay #1 energized)
FAIL-SAFE DIRECTION [1]	0	LOW *	(< 0.6 VDC, < -10%)
	1	HIGH	(> 5.4 VDC, > 110%)
HOLD LAST KNOWN GOOD VALUE [1]	0	DISABLE *	(use Fail-Safe)
	1	ENABLE	**[SEE WARNING]**

* *Indicates the factory default setting.*
[1] *Active only if the Analog Repeat option is* installed.

NOTE: RELAY #1 configured for *"Status Only"* action provides an independent indication of transmitter status. RELAY #2 always provides the PV TRIP indication.

WARNING: **For ANALOG inputs the use of RELAY #1 *"Status Only"* action and HOLD LAST KNOWN GOOD VALUE features are NOT RECOMMENDED. Although they will work in many cases, proper action is NOT GUARANTEED.**

PV/SV SELECTION

The MTS may be configured to trip a relay on either a DIGITAL or ANALOG input signal. See *Table 3 - Configuration switch descriptions*.

DIGITAL

All PVs (PV1, PV2, PV3, PV4) are available to the MTS provided they are enabled in the transmitter.

Only TEMPERATURE SVs that are cyclically broadcasted are available to the MTS provided they are enabled in the transmitter. SVs that are part of the transmitter database are NOT available to the MTS. Therefore, only SV1 is available from selected transmitters.

If the *Analog Repeat* output is configured for PV1 through PV4, it will track the transmitter's PV value, nominally 0-100%, with 1-5volts. There is a ±10% over/under-range provided.

If the *Analog Repeat* output is configured for SV1, it will follow the transmitter's SV value normalized to 0-100% of either the FULL range, -40ºC to +110ºC or NARROW range, 0ºC to +100ºC, depending on the internal MTS configuration switch setting. There is also a ±10% over/under-range provided.

Refer to *Table 4 - Multi-Variable Transmitter PVs and SVs* and *Table 5 - Single-Variable Transmitter PVs and SVs* for a specific list of which measured variables are available to the MTS for each specific transmitter type.

Table 4 - Multi-Variable Transmitter PVs and SVs

	MAG or SMT	SGC	SLT	SMV
PV1	Volumetric Flow	Gas Component	Level	DP
PV2	Temperature	Gas Component	Level | Mass | Volume[1]	AP
PV3	Calculated Mass Flow	Gas Component	n/a	Temperature
PV4	n/a	Gas Component	n/a	Compensated Flow
SV1	Totalized Flow[2]	T_{oven} | $P_{Carrier\ Gas}$[2] | P_{atmos}[2]	n/a	Sensor Temperature
SV2	Compensated Density[2]	n/a	n/a	n/a
SV3	Totalized Mass[2]	n/a	n/a	CJT[2]

[1] = choice of one [2] = not available for MTS

Table 5 - Single-Variable Transmitter PVs and SVs

	ST	STT	MagneW
PV1	Pressure	Temperature	Volumetric Flow
SV1	Sensor Temperature	Cold Junction Temperature	Totalized Flow[2]

[2] = not available for MTS

ANALOG

The MTS may be configured to trip a relay on analog CURRENT (4-20mA). The MTS will also accept VOLTAGE (1-5volts) provided the input signal is capable of driving the 250 Ohm load presented by the MTS.

TRIP DIRECTION

The MTS can be configured to trip either HIGH or LOW. Refer to *Figure 9 - Hysteresis Characteristics*.

RELAY #1 ACTION

RELAY #1 (TRIP/STATUS) trip action is user configurable to provide an independent indication of a transmitter MAINTENANCE problem versus a PV/SV Trip. By providing an independent indication and incorporation into the shutdown strategy, maintenance action may be taken and a process upset or shutdown avoided. Transmitter maintenance problems are indicated via the "Smart Status" LED and additionally **RELAY #1** may be configured to independently indicate ONLY the "Smart Status" via the **RELAY #1 ACTION** internal DIP configuration switch. See *Table 3 - Configuration switch descriptions*.

RELAY #2 (TRIP) is not configurable and will always act on the PV/SV TRIP POINT only.

FORCED I/O MANUAL ACTION

The MTS may be configured to indicate either GOOD or BAD status when the transmitter's *input* or *output* is in a forced manual mode (e.g. Output Mode). This is user configurable to effect the "Smart Status" which will trip RELAY #1. See *RELAY #1* ACTION section.

Normally it is desirable to allow the MTS to "trip" when this condition is detected. This prevents inadvertently leaving a transmitter in a forced manual state. In other applications where the MTS is within a loop that requires periodic validation, it is recommended that configuration be set to "not trip". For either configuration, the MTS will allow the forced value of the PV or SV to pass through to the *Analog Repeat* output.

FAIL-SAFE DIRECTION and HOLD LKG VALUE

(Analog Repeat option only)

ANALOG OUTPUT FAULT VALUE: The MTS analog output may be configured to take 1 of 3 possible actions should a PV or SV go BAD (e.g. missing, dropout or bad transmitter status):

Fail-Safe High = > 5.4 Volts
Fail-Safe Low = < 0.6 Volts
Hold Last Known Good (LKG) Value

For DE inputs, this occurs after the receipt of a "Bad Transmitter Status".

For ANALOG inputs, this occurs when the signal is outside the 4-20mA. range or if the input is open. LKG is NOT RECOMMENDED with analog inputs since the value held may not be correct for low slew rate input signals.

INDICATORS

Five (5) LED indicators are located on the top face of the MTS module which provide concise indication of all activity and status. The top label also contains a legend table for the STATUS LED.

At least one LED will be ON or BLINKING when module **power** is present.

STATUS

The red *"**STATUS**"* LED has several modes of indication; ON, Blink - *slow*, Blink - *fast*, Blink - *double* and OFF. Refer to *Table 6 - "STATUS" LED Description*.

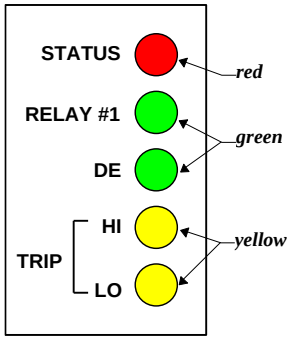


Figure 11 - LEDs

Table 6 - "STATUS" LED Description

LED STATE	DESCRIPTION	**RATE** (approx.)
OFF	Normal	-
BLINK - *slow*	Tripped, Bad Transmitter Status, Missing PV or SV Forced I/O Manual Mode	short blink, 1 per sec long blink, 1 per sec
- *fast*	MTS Test Mode	6 per sec
- *double*	Analog Output Fault	2 blinks, 1 per sec
ON	MTS Module Fault	-

RELAY #1

The green *"**RELAY #1**"* LED is ON when the TRIP/STATUS Relay #1 is energized, the "not tripped" state. This LED is electrically in series with the relay coil and serves as indication of current flow through the relay coil.

DE

The green *"**DE**"* LED is ON when the MTS is configured for any *digital* PV/SV and a valid DE signal broadcast by the transmitter is received by the MTS. The LED is OFF when the MTS is configured for an *analog* input.

LO/HI TRIP

The two(2) yellow "***LO/HI TRIP***" LEDs indicate both the trip direction (selected internally) and trip state**.**

When the MTS is powered, the configured PV/SV TRIP DIRECTION LED (**LO** or **HI**) is ON.

When the MTS is in the TRIPPED state (relay de-energized) the corresponding LED will BLINK.

OPERATION

POWER-UP

At power up, at least one of the LEDs should be ON indicating power to the MTS. The MTS has been designed to power up before the transmitters are ready. As such, the MTS will acquire the first available DE signal, Status, PV/SV or analog PV. After a valid DE signal is recognized, the green *"**DE**"* LED will also light.

NORMAL

The MTS will NOT indicate GOOD status until the PV/SV information required via the internal user selectable switches has been acquired free of error. Under normal conditions this will typically be less than 5 seconds. However, some transmitter types may take as long as 60 seconds to broadcast the required information.

TRIP

The MTS will trip immediately after receipt of a valid PV/SV that is equal to or exceeds the configured trip point value. RELAY #1 (unless configured for *STATUS ONLY*) and RELAY #2 will de-energize. The yellow ***"LO/HI TRIP"*** LED will *BLINK*.

BAD STATUS or FAULT

ANY fault will be indicated by the red ***"STATUS"*** LED via one of the *BLINK* or *ON* states shown in *Table 6 - "STATUS" LED Description* accompanied by the green **"RELAY #1"** LED turning OFF (relay de-energized). RELAY #2 does NOT react to BAD transmitter status, only validated PV/SV trips.

TROUBLESHOOTING

The MTS has internal power-up diagnostics, run-time diagnostics, watch dog timer and analog output fault detection. Follow these troubleshooting steps to determine the problem source:

Step 1: *CHECK FOR POWER*

At least one LED will be ON or BLINKING to indicate module power is present. Typically the corresponding yellow "***LO/HI TRIP***" LED will be ON when the MTS is connected to a +24VDC power supply. Voltage may be checked at MTS terminals 12 & 9.

If the MTS *"**LO/HI TRIP**"* LED is OFF, the MTS power output may be overloaded. That voltage may be checked at MTS terminals 5 & 9. The MTS will automatically restore the power output within 60 seconds after the short is removed. If this does not occur, the MTS module has failed.

Only one yellow "***LO/HI TRIP***" LED should be ON. If both LEDs are ON, the MTS module has failed.

Step 2: *CHECK FOR DE*

The green *"**DE**" L*ED is ON when a DE signal is broadcast by the transmitter. If this LED is OFF, check that the transmitter is wired correctly, powered and NOT in ANALOG MODE. The MTS is a passive device. As such, the transmitter must be placed in DE MODE from a handheld communicator (e.g. SFC or SCT).

Step 3: *CHECK FOR OUTPUT SHORTS (CROSSWIRING)*

If the *Analog Repeat* option is installed, the red *"**STATUS**"* LED will double blink ON to indicate that the MTS analog output has been wired incorrectly, is shorted or overloaded. Check the analog output wiring with the WIRING DIAGRAMS section.

Step 4: *BAD "SMART STATUS"*

First check for the presence of a DE signal. The green *"**DE**"* LED must be ON.

The red *"**STATUS**"* LED will be ON or BLINK to indicate the specific bad status. Most commonly the PV/SV configuration of the transmitter and MTS do not agree and the MTS has not received a required value from the transmitter. Also, check that the transmitter has not been left in a forced input or output manual mode, e.g. OUTPUT MODE. Refer to *Table 6 - "STATUS" LED Description* to isolate the problem.

Step 5: *RELAY ACTION BACKWARDS*

Relay #1 and #2 are normally energized for good transmitter status and no PV trip. Therefore, the N.O. relay contacts are CLOSED for normal operation with good transmitter status and no PV trip.

Step 6: *CHECK GROUNDS*

Check that all wiring is in accordance with the recommended wiring diagrams. Note that additional wires may be required in noisey environments. Check that the MTS ground has NOT been incorrectly wired to another ground. The MTS chassis is electrically isolated from the DIN rail.

Step 7: *CHECK FOR MTS FAILURE*

If the red *"**STATUS**"* LED is ON steady, the MTS module has failed and should be replaced.

Step 8: *TEST MODE*

To test the operation of the MTS, ground TEST terminal 11 to POWER GROUND terminal 9. All relays will de-energize and the green "***RELAY #1***" LED will go OFF. The red *"**STATUS**"* LED will FAST blink. The optional *Analog Repeat* output will go to 3.00 volts, 50%. When the jumper is removed normal operation will resume.

SPECIFICATIONS

# Inputs:	1
Input Types: (DE) (Analog)	Honeywell DE, 4 or 6 byte, multivariable broadcast formats A thru F [*listen* only] 4-20mA. (or 1-5 volts into 250Ω)
Input (Loop) Loading:	DE: 10 Kohms, min.
Input Common Mode:	50 VDC, max.
DE PV/SV Selection:	PV1, PV2, PV3, PV4 or SV1 (switch configurable)
Trip Range:	0 to 99.9%, in increments of 0.1%, LOW or HIGH
Trip Error:	DE input: Zero, Analog input: ±1%, max.
Trip Point Resolution:	DE input: 16 bits, Analog input: 8 bits
Trip Point Hysteresis:	DE input: 0.25%, Analog input: 2%
Trip/Status Throughput Delay:	DE input: 25 msec., Analog input: 60 msec., max.
Relays: (Type) (Action)	2 @ 1 Form A and 1 Form B, 5A @ 30VDC, 250VAC, 0.1HP, 100K actuations, min. [5] Relay energized when not *tripped* and "Smart Status" = good. [1]
Analog Repeat Output: *[optional]*	1 @ 1-5 volts, nom. ±10% over/under-range, min.
Analog Output Accuracy:	Reference: ± 0.045% F.S., max. into 10 Kohms, min. @ 25°C Standard: ± 0.2% F.S., max. into 10 Kohms, min. @ 0°C to 60°C
Analog Output Resolution:	12 bits
Analog Out Update Rate[2]: (PV) (SV)	3.6/sec. @ 4 byte mode, 2.7/sec. @ 6 byte mode Temperature ONLY. Rate varies with field device, refer to field device specification.
Analog Out Throughput Delay:	50 msec., max. to 99% of new PV/SV value
Fault States: (Trip/Status) (Analog)	Relay de-energized = tripped, status bad Fail-Safe LO/HI or Last Known Good value (switch configurable)
"Smart Status":	Transmitter status, forced I/O manual mode [3], DE signal integrity, MTS test mode and MTS module fault.
LED Indicators (5): LO/HI RELAY #1 DE STATUS	Yellow: ON indicates configured HIGH or LOW trip selection. BLINKS when *tripped*. Green: ON when NOT *tripped* (relay energized) and "smart status" = good. Green: ON when DE signal is present. Red: OFF when NOT *tripped* and "smart status" = good. BLINKS when *tripped*, "smart status" = bad. ON steady for MTS module fault.
Transmitter Forced I/O Action:	MTS switch selection configures STATUS relay trip action
Test/Validation Mode:	Trips relays (de-energized), LEDs indicate BAD status, analog output forced to 3.00 volts
Field Communicator Interaction:	DE input: No impact to PV/SV accuracy or status state. Value may be delayed due to interleaved communications.
Power Consumption:	80 mA., typ. @ +24VDC (excluding field device)
Power Supply:	+22.5VDC to +30VDC, +24VDC nom.
Safety Barrier Compatibility:	Compatible with commercially available "smart" safety barriers [4]
Size:	4.51"(H) x 0.89"(W) x 3.9"(D)
Operating Temperature:	0°C to 60°C, ambient
Storage Temperature:	-55°C to +125°C, ambient
Operating Humidity:	10-95% RH, max. non-condensing
Connectors:	Screw type, compression, removable, keyed, corrosion resistant
Enclosure/Mounting:	IP 20 / 35 mm DIN Rail (EN 50022) mounted equipment

CE Conformity (Europe)	This product conforms to the protection requirements of the following European Council Directives: 73/23/EEC, the Low Voltage Directive, and 89/336/EEC, the EMC Directive. Conformity of this product with any other "CE Mark" Directive(s) shall not be assumed.
Product Classification:	Class I: Fixed, Permanently Connected, Equipment. (EN 61010-1)
Installation Category (Overvoltage Category):	Category II: Energy-consuming equipment supplied from the fixed installation. Local level appliances, and Industrial Control Equipment. (EN 61010-1)
Pollution Degree:	Pollution Degree 2: Normally non-conductive pollution with occasional conductivity caused by condensation. (ref. IEC 664-1)
EMC Classification:	Group 1, Class A, Industrial Control Equipment (EN 55011, emissions) Generic Immunity, Industrial (EN 50082-2, immunity)
CSA Certification (Canada)	CSA C22.2 No. 205M – Signal Equipment
UL Standard (USA)	CSA NRTL/C, UL 1635 – Digital Alarm Communicator System Unit

[1] PV/SV TRIP and STATUS actions may be separated on RELAY #1. The STATUS relay is de-energized (tripped) on transmitter status of CRITICAL, NON-CRITICAL, BAD PV, FORCED I/O MODE, no DE, missing PV/SV or MTS module fault.

[2] The actual rate depends on the broadcast format configured in the field instrument.

[3] Transmitter forced I/O manual mode response action is user configurable on the MTS.

[4] Refer to the Honeywell PM/APM Smartline Transmitter Integration Manual, PM12-410.

[5] CSA relay rating is at 25°C, 50%RH.

Figure 13 - Functional Diagram

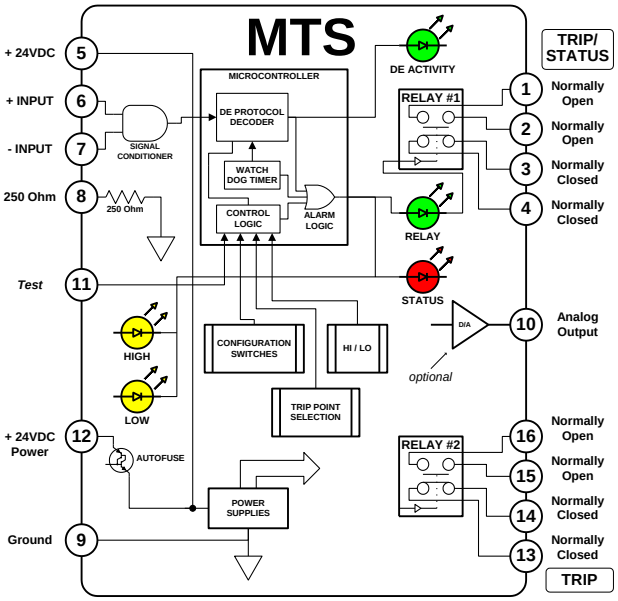
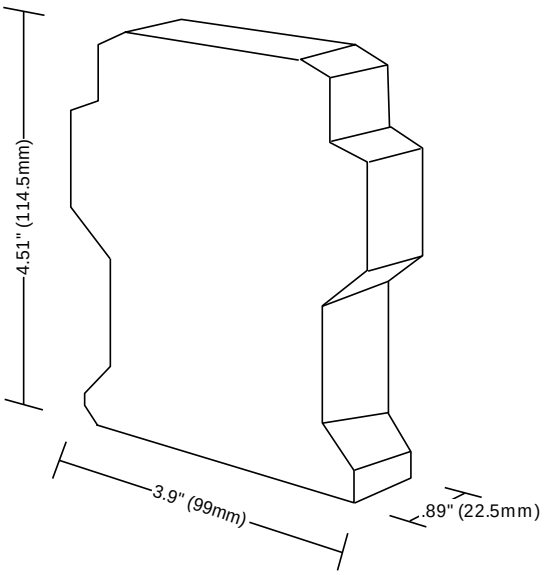


Figure 12 - Package Outline



MODEL SELECTION

M T S - 1 x y - z where: **x** = number of analog outputs, **0** or **1**

y = number of relays, **2** (std.)

z = option selection(s), '**-E**' specifies European CE Compliance

Note: Custom factory configuration not covered in this guide is available for RELAY ACTION, HYSTERESIS VALUE and TIME DELAY.

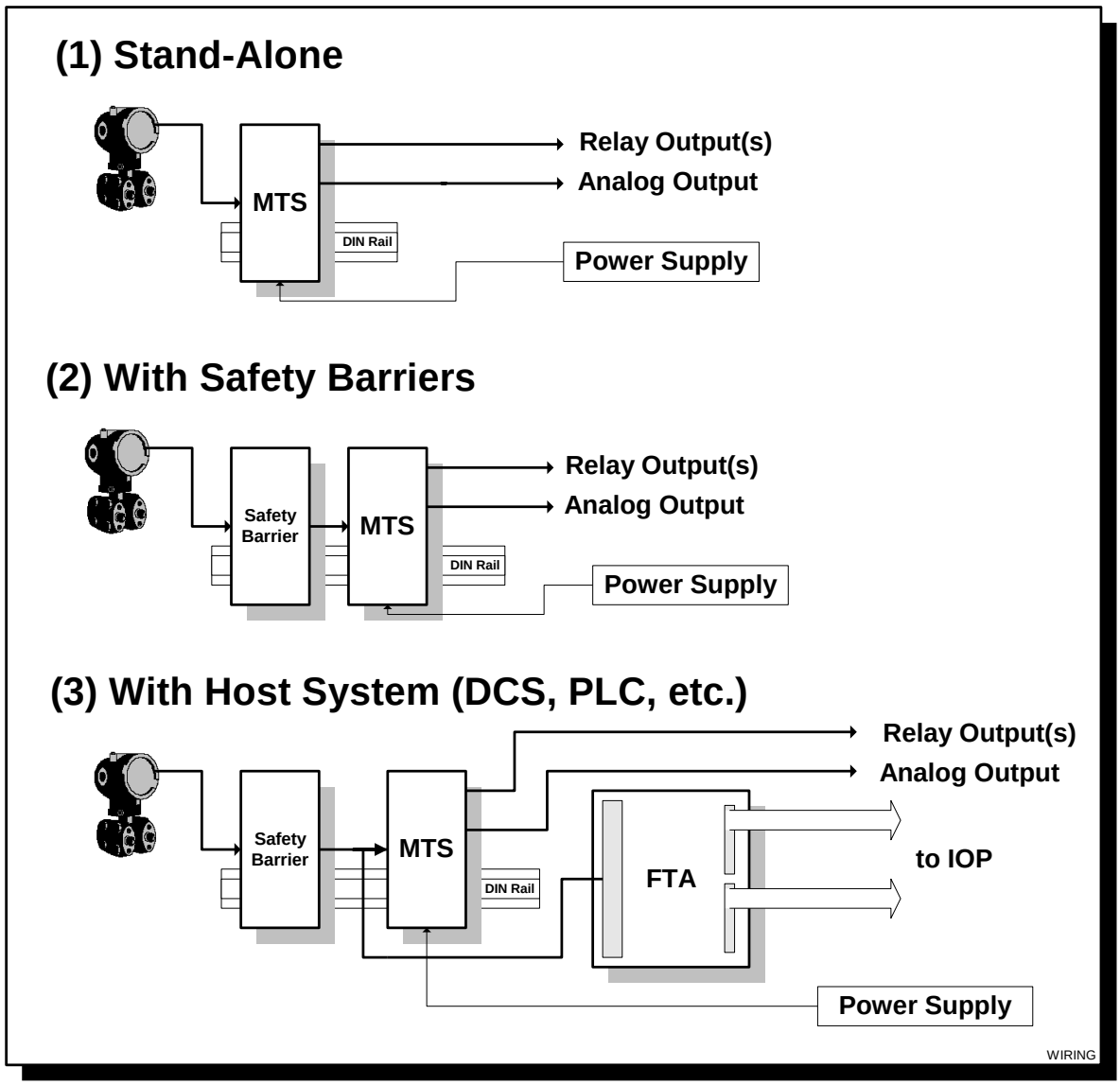
WIRING DIAGRAMS

The *Figure 14* shows basic usage scenarios of the MTS. Detailed wiring diagrams are shown in the following figures. *Where the* bulk 24VDC power supply is not readily accessible, the MTS may be powered from 120VAC using a DIN rail power supply with the same form factor, like the Phoenix Contact MCR-PS-120AC/24DC/650.

Figure 15 illustrates how to provide MTS power from a Honeywell system. *Figure 16* through *Figure 23* are wiring diagrams when using a *digital* DE input. *Figure 24* and *Figure 26* are wiring diagrams when using an *analog* 4-20mA. or 1-5volt input. *Figure 28* shows how to wire the optional *Analog Repeat*.

NOTE: For *analog* 4-20mA. or 1-5volt inputs the MTS INTERNAL LOOP RESISTOR MUST BE USED. It is good practice to also provide the loop power via the MTS but this is not a requirement. For a *digital* DE input there are no such restrictions.

Figure 14 - Basic MTS Wiring Scenarios



NOTE 1. The insulation of wires connected to the Control and Relay terminals shall be rated for the highest voltage involved. Extra Low Voltage (ELV) wiring (input, output) shall be separated from HAZARDOUS LIVE (>50 Vac, or 75 Vdc) Low Voltage (LV) Relay circuits.

NOTE 2. The Analog Output is 1-5 volts (not 4-20ma.). DAMAGE will occur to the MTS if connected to a current loop voltage source.

Detailed Honeywell transmitter and I.S. barrier wiring diagrams can be found in Honeywell document # 30753667.

POWER

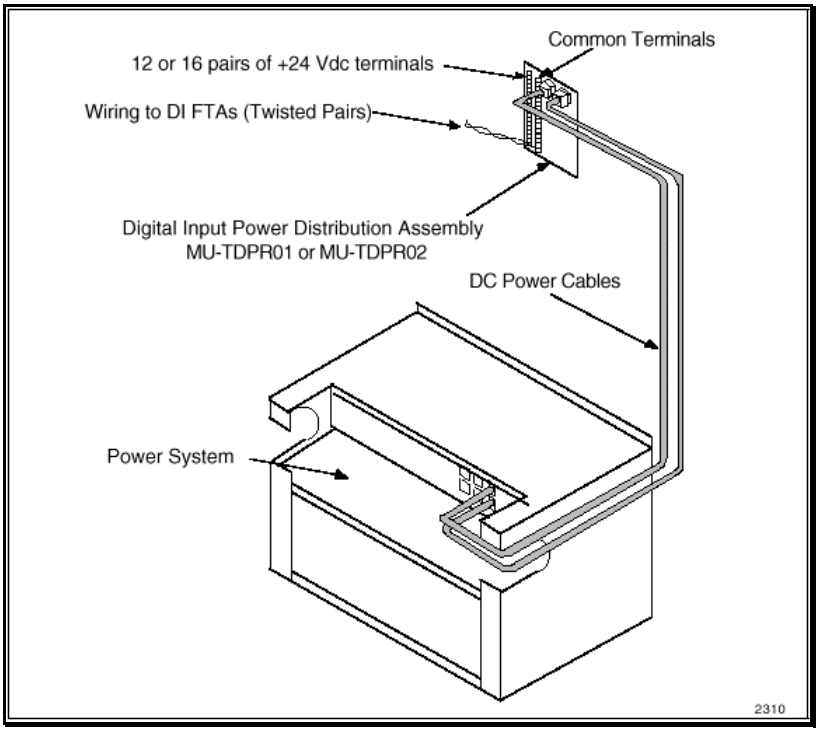
The +24VDC power for the MTS should be supplied from a bulk power supply since most supply connections to the field instruments are current limited. If different power sources are used, they are permitted to have a ground potential difference of up to 50VDC. Transmitter loop power from the MTS is short circuit protected to 300 mA.

To power the MTS from a Honeywell host system 24VDC bulk power supply, connection to a *Power Distribution Assembly* similar to model # MU-TDPR01 is recommended, where terminal TB1 is GND and TB2 is +24VDC. See *Where the* bulk 24VDC power supply is not readily accessible, the MTS may be powered from 120VAC using a DIN rail power supply with the same form factor, like the Phoenix Contact MCR-PS-120AC/24DC/650.

Figure 15.

Where the bulk 24VDC power supply is not readily accessible, the MTS may be powered from 120VAC using a DIN rail power supply with the same form factor, like the Phoenix Contact MCR-PS-120AC/24DC/650.

Figure 15 – Honeywell TPS 24VDC Power Distribution Assembly



DIGITAL DE INPUT

Figure 16 through *Figure 23* are wiring diagrams when using a *digital* DE input. *Figure 16* and *Figure 17* show the most common MTS wiring for the *digital* DE input.

Figure 16 - Stand Alone or with Analog Input Host

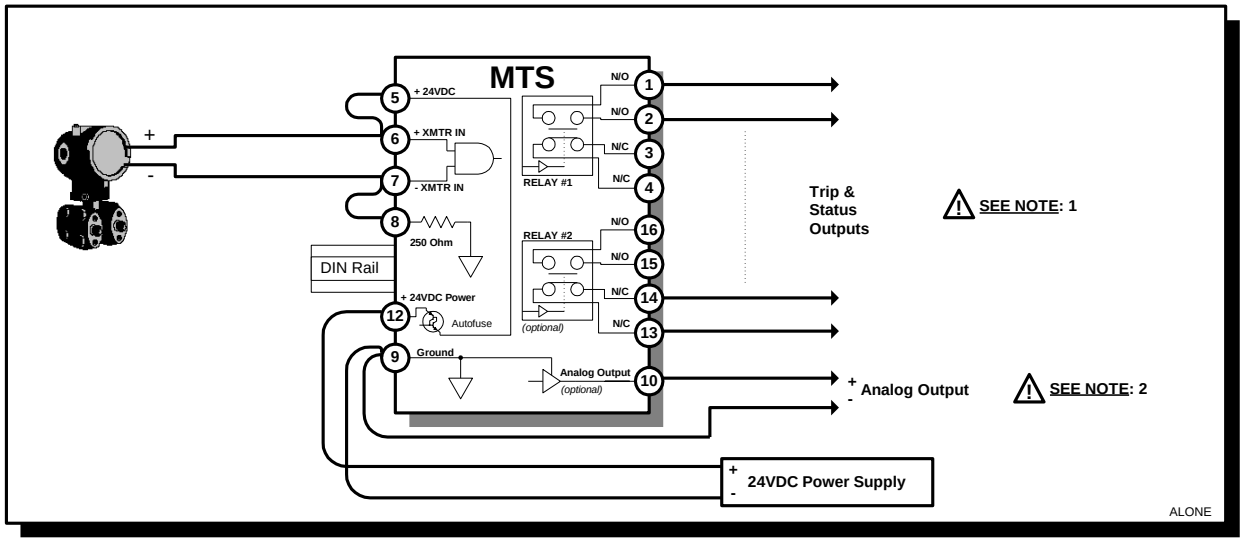


Figure 17 - DE Input Host (TPS, TDC2000, TDC3000, AB PLC)
If host system does NOT accept DE, wire as shown in *Figure 16 - Stand Alone or with Analog Input* Host.

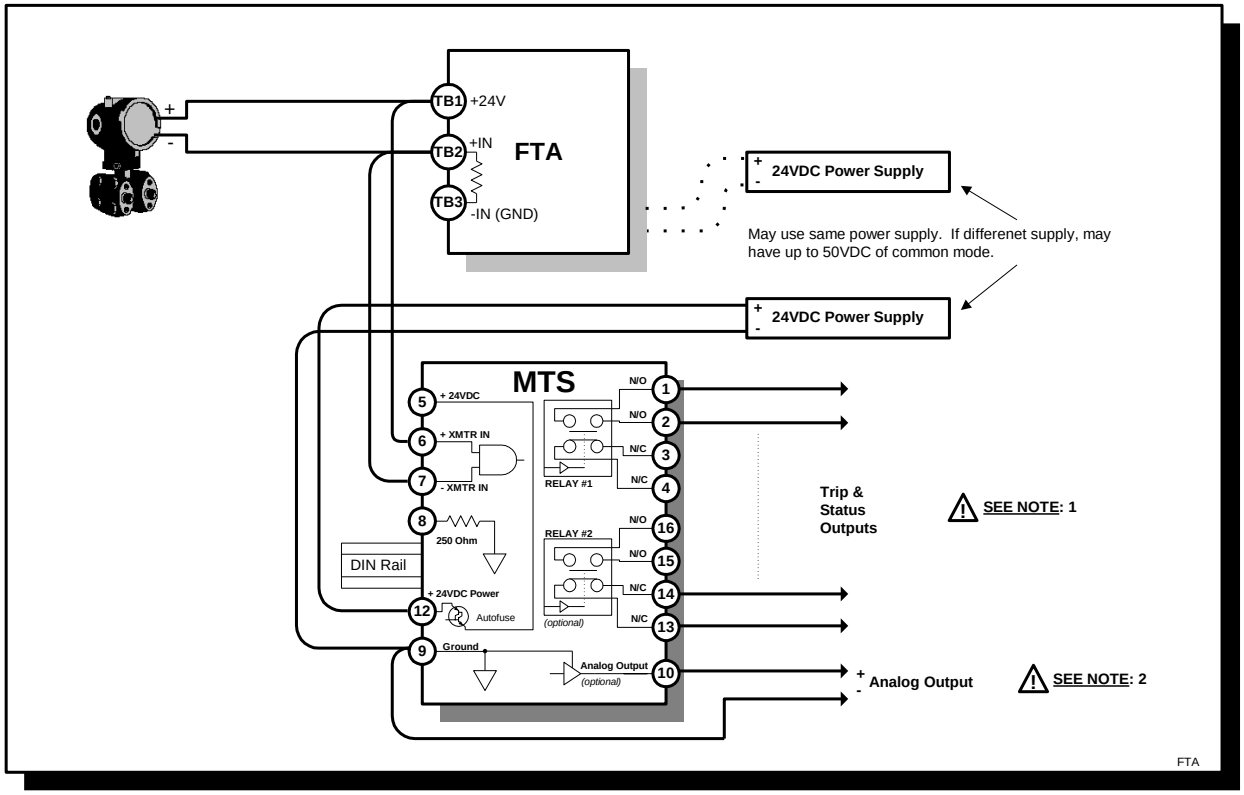


Figure 18 - DE Input Host (alternate)

This wiring diagram is an alternate to that shown in *Figure 17*.

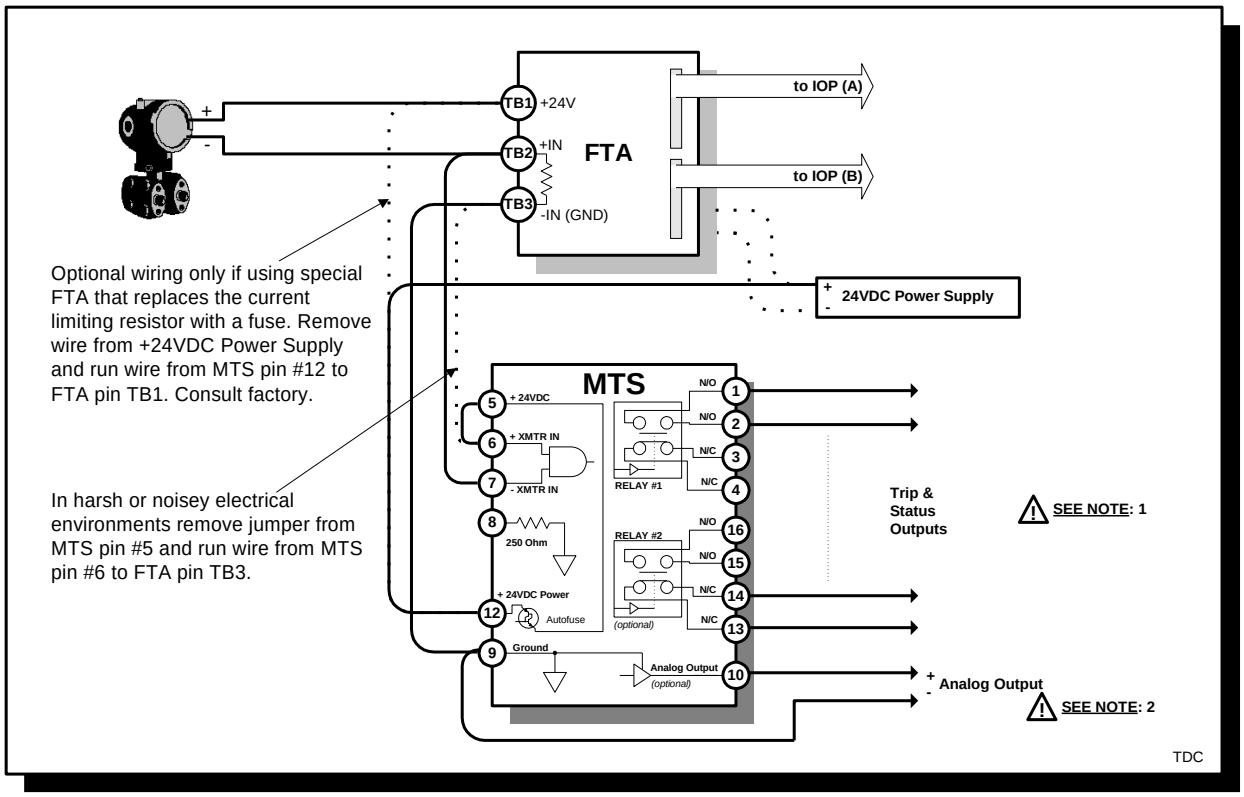


Figure 19 - TPS/TDC and MTL3046B Safety Barriers

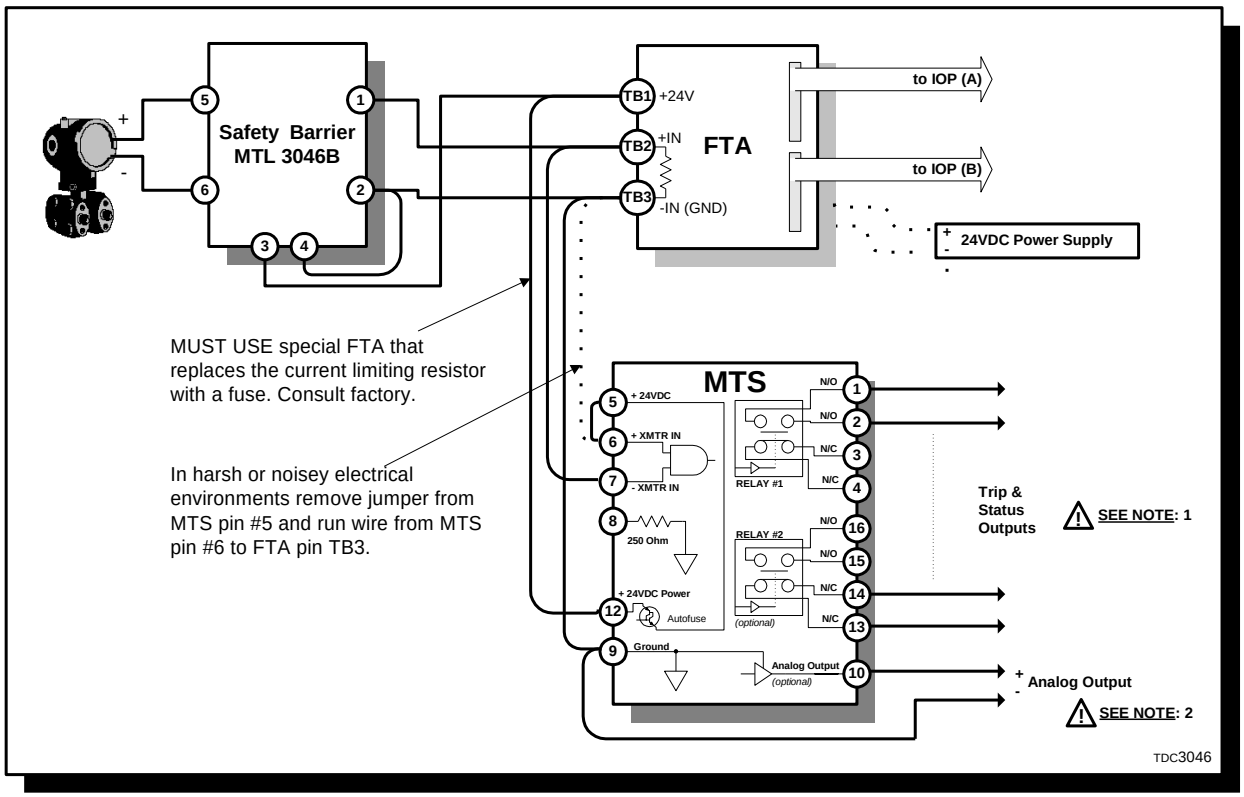


Figure 20 - TPS/TDC and MTL706 Safety Barriers

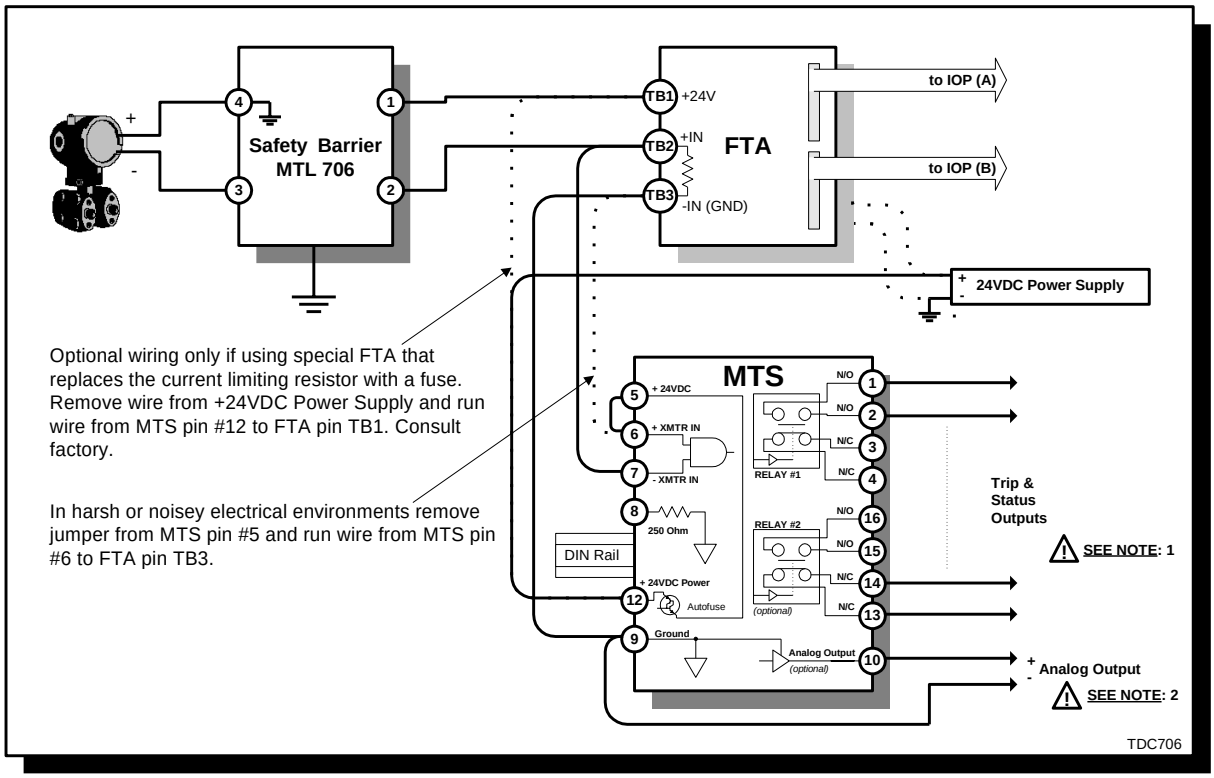


Figure 21 - Stand Alone with Safety Barriers

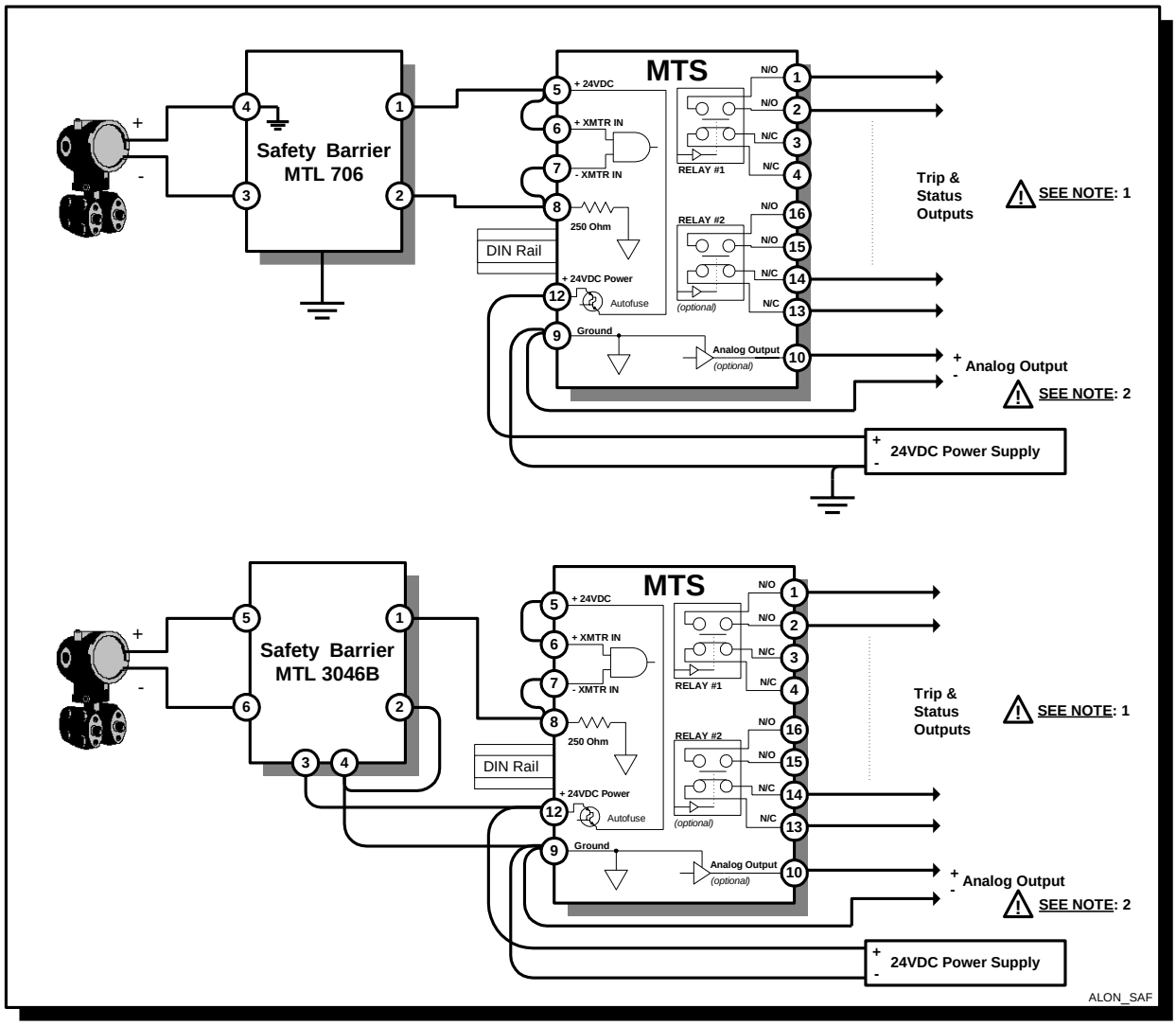


Figure 22 - TPS/TDC with Galvanically Isolated FTA
(Figure NOT shown.)

When using the MTS with the galvanically isolated FTA a separate marshaling panel needs to be installed. Refer to Honeywell document PM20-520, Process Manager I/O Installation Guide. The MTS should be wired to TB1 on the marshaling panel similar to that shown in *Figure 18*.

Figure 23 - Safety Shutdown Systems
(Figure NOT Shown.)

All **Triconex** safety shutdown system Analog Input modules accept the MTS *analog repeat output* as a voltage input. The correct Input Termination Assembly is #2700-1 for "voltage in" or the equivalent FTA. Use the "-" and "+" terminals. Do NOT use Termination Assembly #2700-2 or -4 as they are designed for 4-20mA. and have an internal loop resistor which will introduce errors.

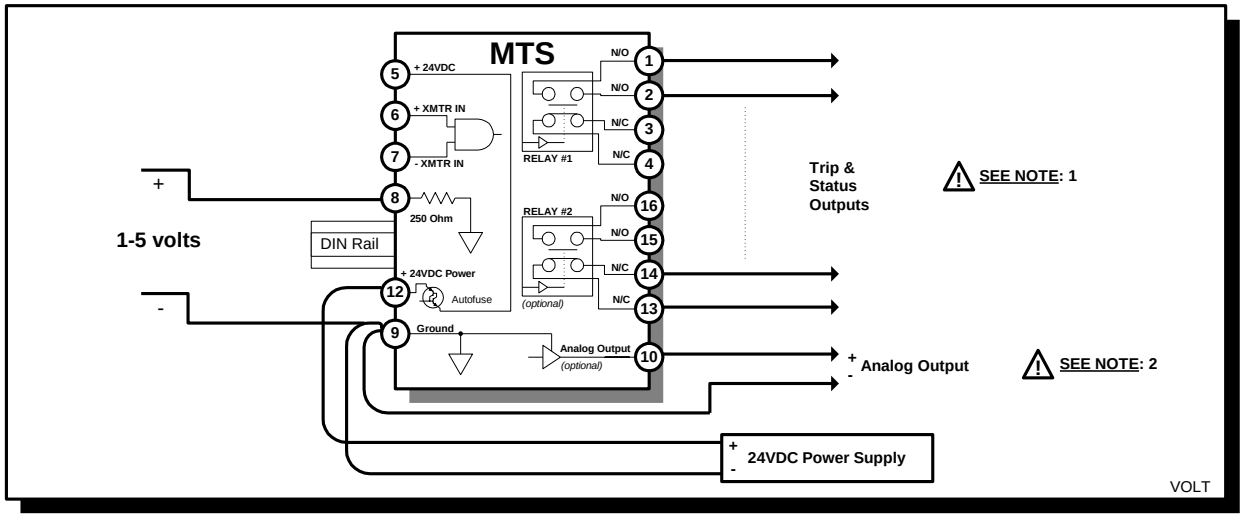
The Honeywell **Safety Manager** (formerly FSC) Analog Input modules 10102/1/1 or 10102/1/2 accept the MTS *analog repeat output* as a voltage input. Wire as a "passive" device. Use the "0 v" and "volt" terminals on the /1 model and the "0 V" and "IN" terminals on the /2 model.

ANALOG 4-20mA. or 1-5volt INPUT

Figure 24 through *Figure 26* are wiring diagrams when using an *analog* 4-20mA. or 1-5volt input.

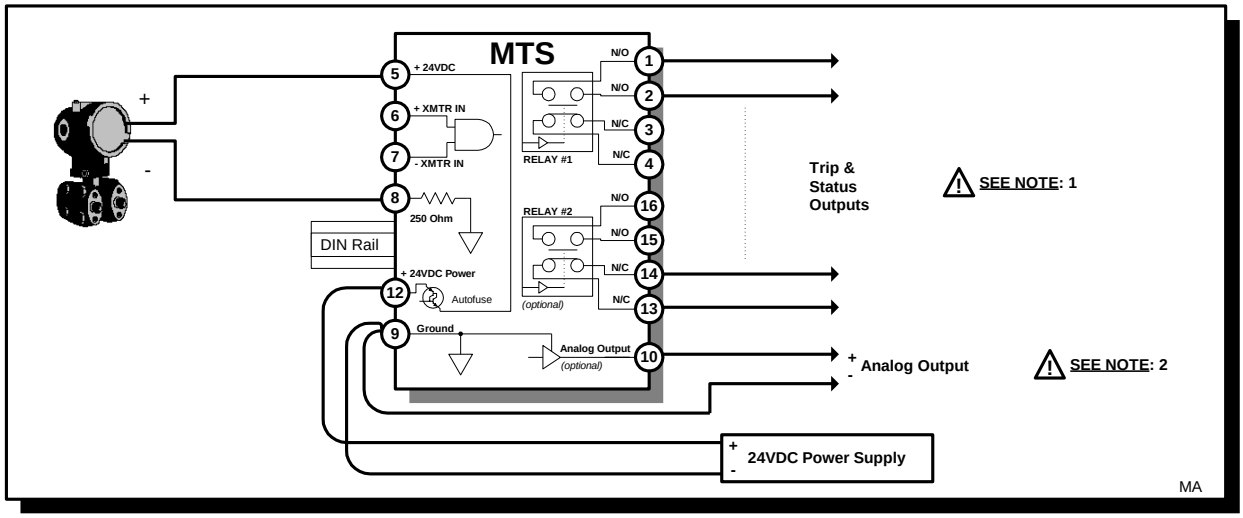
NOTE: For *analog* inputs the MTS INTERNAL LOOP RESISTOR MUST BE USED. This resistor value has been characterized for optimal MTS performance and the voltage developed at pin #8 should NOT be used elsewhere. It is good practice to also provide the loop power via the MTS but this is not a requirement.

Figure 24 - Analog 1-5volt Input



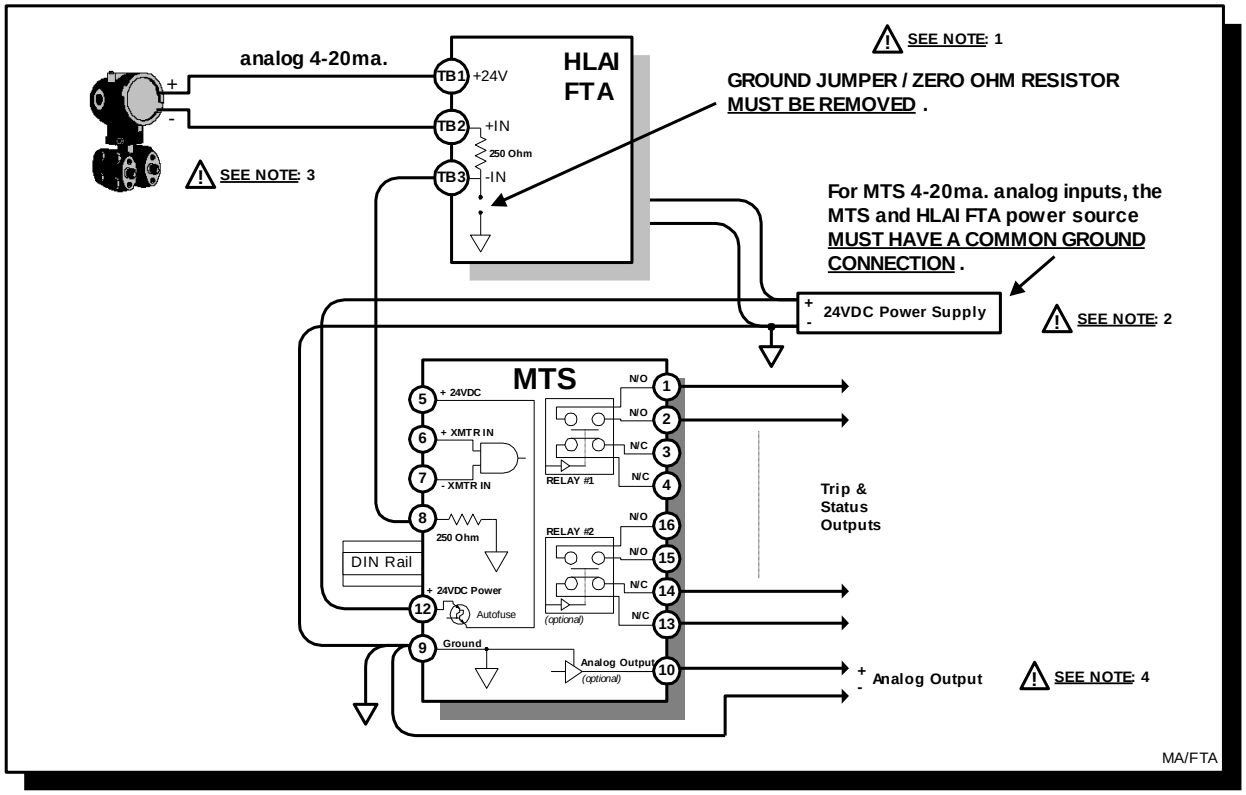
NOTE: The *analog* 1-5volt input signal source must be capable of driving the 250Ω load presented by the MTS's internal loop resistor.

Figure 25 - Analog 4-20ma Input



NOTE: The MTS internal loop resistor value has been characterized for optimal MTS performance and the voltage developed at pin #8 should NOT be used elsewhere.

Figure 26 - Analog 4-20ma Input and HLAI FTA



NOTES:

[1] The GROUND JUMPER or 0Ω RESISTOR on the HLAI FTA MUST BE REMOVED to allow the HLAI input to float. Exact HLAI FTA terminal numbers may vary with FTA model. Specific instructions are in Honeywell Process Manager documentation (e.g. PM20520).

[2] For MTS 4-20ma. analog inputs, the MTS and HLAI FTA power source MUST HAVE A COMMON GROUND CONNECTION. The +24VDC power for the MTS should be supplied from a bulk power supply since most supply connections to field instruments are current limited. To power the MTS from a Honeywell 24VDC bulk power supply, connection to a *Power Distribution Assembly* similar to the Honeywell model # MU-TDPR01 is recommended, where terminal TB1 is GND and TB2 is +24VDC. Where the bulk 24VDC supply is not readily accessible, the MTS may be powered from 120VAC using a DIN rail power supply with same form factor, like the Phoenix Contact MCR-PS-120AC/24DC/650, provided it use the SAME GROUND AS THE HLAI.

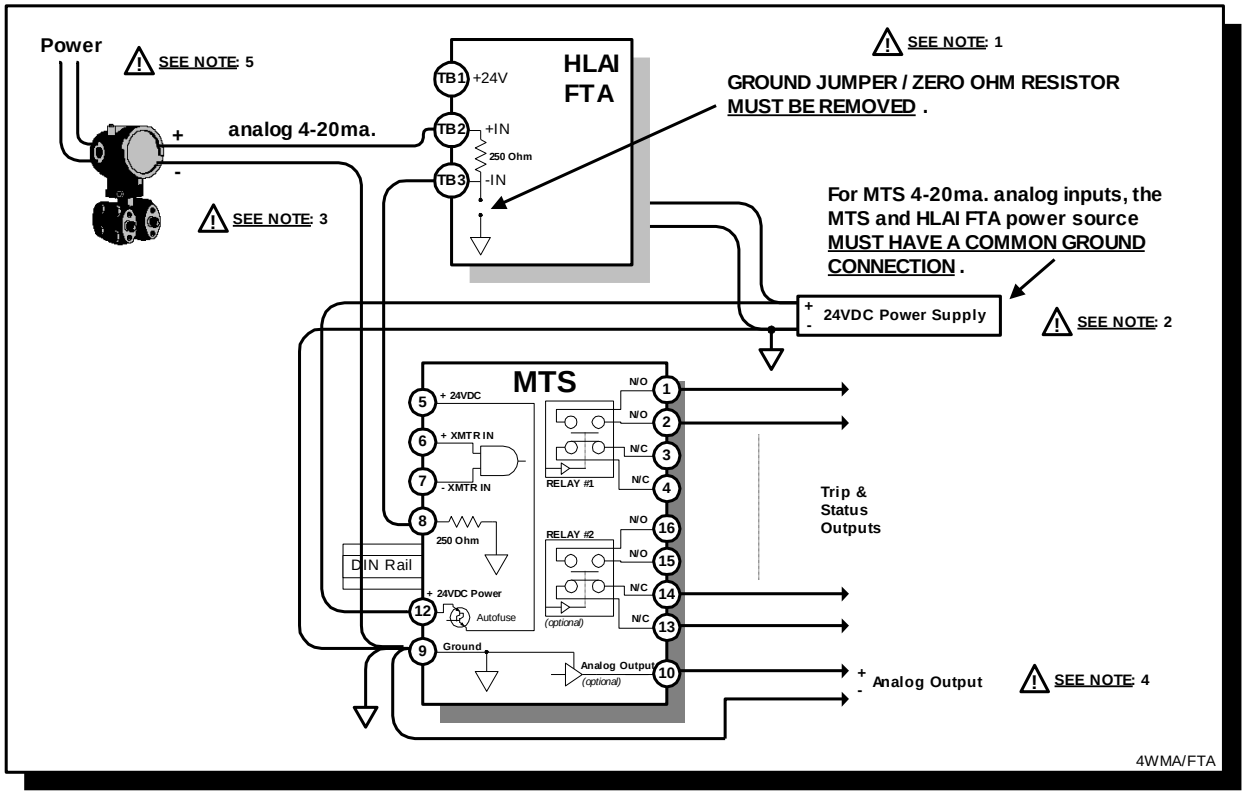
[3] Since the MTS is in series with the current loop, there will be an additional 4volt drop in the loop. Voltage margins should be checked:

Example:

Margin = [FTA + MTS + Transmitter + Wiring] – [Loop Supply Voltage]
= [4 + 4 + 11 + 1] – [24]
= [20] – [24]
Margin = 4 Volts

[4] The MTS Analog Output is 1-5 volts (not 4-20ma.). DAMAGE will occur to the MTS Analog Output if connected to a current loop voltage source.

Figure 27 - Analog 4-Wire 4-20ma Input and HLAI FTA



NOTES:

The same notes [1] through [4] from *Figure 26* also apply to *Figure 27*.

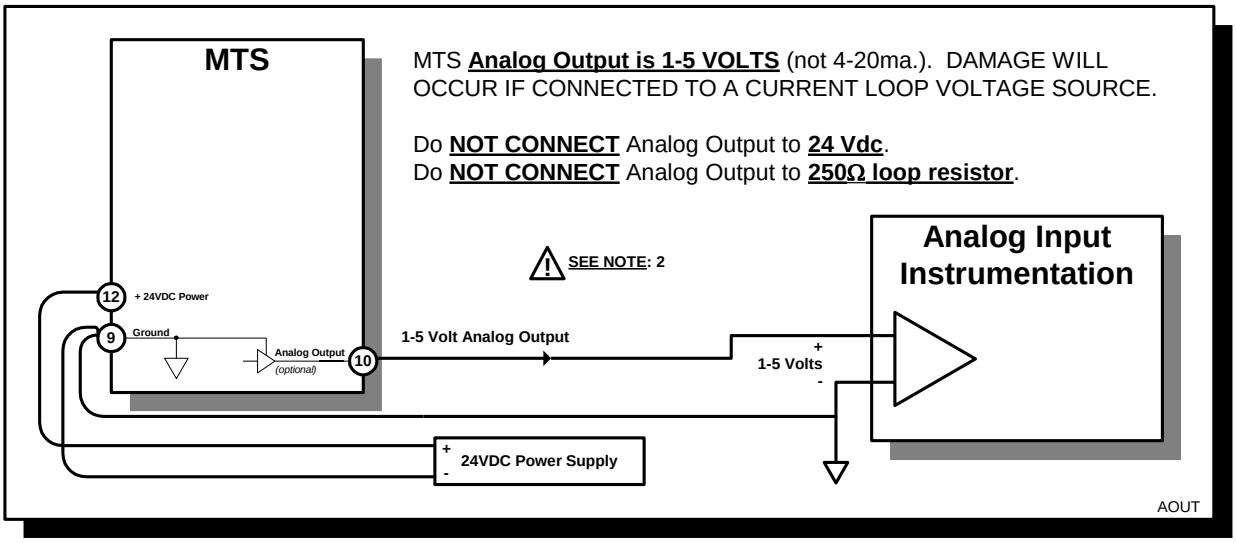
[5] The 4-Wire transmitter power supply or transmitter 4-20ma output MUST BE ISOLATED FROM GROUND. If not, a loop isolator must be used.

ANALOG REPEAT OUTPUT

Figure 28 shows the 1-5 volt analog output wiring when the *Analog Repeat* output option is installed. The MTS should be installed in close proximity to the instrumentation that is receiving the analog output. Wire lengths to the analog instrumentation should be kept as short a possible. Analog output wire runs as long as 50 feet may be tolerated provided the analog instrumentation has differential input capability. A separate analog signal return wire from the MTS should be provided which is not used to carry other return signals or power. Following these precautions will help maintain the rated accuracy of the MTS analog output.

NOTE: The MTS Analog Output is 1-5 volts (NOT 4-20ma.). DAMAGE will occur to the MTS if connected to a current loop voltage source.

Figure 28 - Analog Repeat Output



FREQUENTLY ASKED QUESTIONS

1. What field instruments can be used?

Every Honeywell field instrument currently being shipped is capable of communication using the DE Protocol. The only exception is early model ST3000 Pressure Transmitters. All ST3000 R100 transmitters from software version 6.2 and beyond are DE capable. (Versions 6.1 and 9.1 are analog only.) All ST3000 R600 transmitters from software version 2.3 and beyond are DE capable. All other ST3000 models are DE capable. All other transmitter types are also all DE capable. A communicator, SFC or SCT, may be used to read the transmitter software revision number.

2. Why is the MTS analog output not 4-20mA. and what is its effect on accuracy?

4-20mA. signals are primarily used for long wire runs to/from the field. As such, the MTS is most effective when the long wire run from the field is the robust 4-20mA. digital DE signal into the MTS. By providing a 1-5volt analog repeat output, the MTS eliminates the error that would be introduced via the 250 Ohm loop resistor (typically 0.1%) when converting the signal back to voltage for the instrumentation. As such, the overall accuracy is improved by eliminating the loop resistor error.

3. How does the MTS increase analog accuracy by 80% ?

With the *Analog Repeat* output option, the precision voltage output increases the overall analog accuracy 80% by eliminating errors introduced in the transmitter's D/A and the 250 Ohm loop resistor. For a typical analog transmitter accuracy of 0.1% and 0.1% loop resistor, the worst case error is **0.2%**. The MTS *Analog Repeat* output is a 0.045% precision voltage output which eliminates the loop resistor and its associated error. The transmitter's digital output accuracy is 0.075%. This produces an overall worst case error of only **0.12%** which is an 80% improvement.

4. What PV and/or SV values can be used?

The MTS is capable of monitoring and outputting an analog signal for PV1 thru PV4 or SV1. See PV/SV application *Table 4* and *Table 5* for details.

5. What are the restrictions on the SV and how is it processed?

The MTS is ONLY capable of outputting an analog signal for SVs that are TEMPERATURE. Additionally, the temperature must be within -40ºC to +110ºC. Transmitters capable of outputting a wider temperature range may still be used as long as the range of interest falls within either the FULL or NARROW range of the MTS (e.g. SGC). The FULL range setting scales the temperature span of -40ºC to +110ºC into 1-5 volts. The NARROW range setting scales the temperature span of 0ºC to +100ºC into 1-5 volts.

6. Can the MTS be used in conjunction with a TPS or TDC system?

Yes. See wiring diagrams for details.

7. Can the MTS be used with 3rd party DE instrumentation (PLCs, RTUs, etc.)?

Yes. Interfacing into other devices is similar to that of TPS/TDC. See wiring diagrams for connection to TPS/TDC system for details.

8. Can the MTS be used in conjunction with safety barriers?

Yes. See wiring diagrams for details.

9. How should the MTS be mounted?

The MTS mounts in any orientation on standard 35mm DIN rail.

10. Are there any environmental restrictions for the MTS?

The MTS is NOT suitable for harsh environments. See specification sheet for limitations.

11. Where should the MTS be located relative to the analog instrumentation?

To avoid common mode problems and noise pickup on the analog repeat output, the MTS should be located in close proximity to the analog instrumentation.

12. Does the MTS need to be located in the control or safety shutdown cabinet?

The MTS may be located wherever is convenient, provided its environmental limits are not exceeded.

13. How can the TRIP and STATUS relay outputs be best utilized?

For safety shutdown systems and interlocks, the relay contact outputs may have a speed advantage over analog interfaces that have delays due to damping or filtering. In addition, by separating the transmitter **status** from the **PV/SV trip**, false process shutdowns are eliminated and corrective maintenance action may be initiated. For transmitter or MTS status annunciation using a host instrument's DI (digital input), you may prefer to connect several MTSs' status outputs serially into a single DI. For rapid pinpointing of a problem device they should be wired separately.

14. Do I need access to view the PV Trip Point and LEDs?

Although it is not required, you may want to view the MTS's PV Trip Point and LEDs during installation, routine maintenance and validation. Consider the mounting location and its accessibility.

15. Can current limiting of the MTS power source inhibit operation?

It could. Most supplies to field instruments are current limited. Refer to the specification sheets to be assured that adequate voltage and current is available for the MTS.

16. How much power is required for the MTS?

At power-up the MTS draws approximately 250mA. for 2 seconds, after which it draws 80mA., excluding the transmitter power.

17. Does the MTS need to be fused?

No. The MTS has an internal self-resetting electronic fuse that should provide sufficient protection from short circuits and/or failures. If it is felt that a fuse is needed, a 250mA. slow-blo is recommended.

18. Must the MTS power the field instrument?

No. Field instruments may be either powered externally or from the MTS. When the MTS is used to provide power, the internal self-resetting electronic fuse protects the field wiring from short circuits. See wiring diagrams for details.

19. Must I use the MTS's internal loop resistor?

For a DE input, NO. Analog inputs MUST use the internal loop resistor. See wiring diagrams for details.

20. Can more than one MTS be used in the same application?

Yes. There is no practical limit.

21. How can the MTS assist with field validation?

The MTS has user configurable "forced input/output manual mode" action. By configuring the MTS action to "not trip", the user is permitted to (via a SFC) force a field instrument's input or output to a known value to validate the host system's action, without having the MTS's status relay indicate BAD. The forced PV/SV value also appears on the MTS optional *Analog Repeat* output. (Note: That configuration setting is NOT the factory default.)

22. How can I maximize the advantages of bumpless SFC communications?

The MTS should be located such that the maximum wire run is from the transmitter to the MTS.

23. Could the MTS impact the process startup sequence?

This should not be a problem because the MTS was designed to power-up before the field instrument.

24. How can I connect a SFC?

The SFC or SCT may be connected at any point along the DE signal. It may be convenient when wiring the MTS to strip back the wires to the transmitter just enough to allow the clip leads access.

25. Everything seems to be wired correctly but the yellow *"DE"* LED is OFF or the red *"STATUS"* LED is ON?

The transmitter may be in analog mode. Using a SFC or SCT change the transmitter communications mode to DE. Also check the transmitter broadcast configuration to be sure the PV or SV variable needed by the MTS is configured correctly in the transmitter.

26. Can I change the MTS configuration switches with power on?

Yes. The MTS will automatically accept the new configuration. Depending on the particular field instrument type, the MTS may take as long as 60 seconds to acquire the new configuration information.

27. How fast does the MTS status respond?

Bad transmitter status is annunciated almost instantaneously. (See "Status Throughput Delay" specification.) A DE signal dropout is annunciated within 500msec. A missing PV signal annunciation is primarily a function of the transmitter broadcast format and always occurs within 15 seconds. A missing SV signal annunciation is also primarily a function of the transmitter broadcast format and always occurs within 60 seconds.

28. What are the advantages of using the DE Protocol and MTS?

There are distinct advantages:

- ZERO ERROR digital PV trip.
- One model with DE or ANALOG 4-20ma. input capability.
- Leverages wiring savings associated with multivariable transmitters via individual trips on any PV.
- Enables full digital, non-bumping communications for any application.
- Eliminates false process shutdowns by isolating transmitter status from PV trip.
- Expands functionality while maintaining full digital integration.
- Increases overall analog accuracy by 80% !

You may wish to refer to MTS sales literature and related articles. It may also be helpful to be familiar with other literature on Honeywell Digital Integration and the DE Protocol.