USB Programmable, DIN Rail Mount, Dual Isolated Transmitter/Signal Splitter w/ Passive DC Current/Voltage I/O and 2-Wire 4-20mA Outputs

Model DT236-0600, DC Current & Low DC Voltage Inputs
Model DT237-0600, DC ±1V/±10V Medium Voltage Inputs
Model DT238-0600, DC ±15V/±150V High Voltage Battery Sources Inputs

USER'S MANUAL

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IMPORTANT SAFETY CONSIDERATIONS

You must consider the possible negative effects of power, wiring, component, sensor, or software failure in the design of any type of control or monitoring system. This is very important where property loss or human life is involved. It is important that you perform satisfactory overall system design and it is agreed between you and Acromag, that this is your responsibility.

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This manual is for Acromag dual channel 2-wire/loop-powered DT23x transmitters that convert DC voltage or current input signals to isolated passive current output loops. If your application requires dual output 4-wire transmitters (w/ separate isolated DC power) that drives sourcing voltage/current outputs, please refer to similar SP33x series models. For thermocouple input signals, please refer to our SP233 (2-wire loop-powered) and SP333 (4-wire DC powered) models.

GETTING STARTED

DESCRIPTION

Symbols on equipment:

Means “Refer to User’s Manual (this manual) for additional information”

Model DT23x-0600 Dual Transmitters provide two isolated ANSI/ISA Type II transmitters with isolated 2-wire current outputs. Units may operate as a dual channel two-wire transmitter, a single channel 1 transmitter, or as a channel 1 signal splitter. These models interface with DC Current or DC voltage input signals according to their model, isolate each input, and separately modulate two isolated 2-wire current loops linearly proportional to their respective inputs.

The DT236-0600 is designed for DC Current (0-20mA/4-20mA) and Low Voltage DC signals (±0.5V/0-500mV). The DT237-0600 is designed for medium voltage DC signals (±1V, ±5V, ±10V), and the DT238-0600 for large Voltage DC signals (±15V, ±75V, ±150V Battery Sources). Units provide an adjustable input range, input isolation, variable input filtering, I/O scaling, and programmable output limits. All units are setup and calibrated using a wired USB connection to a Windows-based PC running configuration software (Windows 7 and later), or an Android-based tablet or smartphone running our Agility mobile APP.

Key Features

- **Digitally configured and calibrated w/ Windows software via USB, or a wired USB-OTG connection to Android smartphones or tablets.**
- **Dual Channels in a thin 17.5mm wide enclosure for high-density mounting.**
- **Operates as a dual transmitter, a single CH1 transmitter, or a CH1 splitter.**
- **High measurement accuracy and linearity with 16-bit I/O conversion.**
- **Adjustable input ranges and output ranges. Transmitter inputs and outputs can be scaled independently and differently for each channel.**
- **Variable input filter adjustment (none, low, medium, or high).**
- **Each transmitter channel supports two input paths according to range model. DT236 channels have separate input paths for 0-20mA/4-20mA/0-11.17mA/±1mA, and ±0.5V/0-500mV. DT237 has separate input paths for ranges up to ±1V and ±10V. DT238 has separate input paths s for high-level ranges up to ±15V and ±150V Battery Sources.**
- **Non-polarized 2-wire loop-powered output channels.**
- **Output channels can transmit Normal or Reverse Acting output signals.**
- **Extra output connection screw supports optional sourced output wire termination (see optional Output/Power Connections).**
- **Up or down-scale lead-break/burnout detection.**
- **Transmitters have very low loop burden with terminal voltage down to 7V.**
- **You may program your own output clamp limits or select Namur compliant range/limits, helpful to discern over-range conditions from fault detection.**
- **Wide ambient temperature operation from -40°C to +80°C.**
- **Thoroughly tested and hardened for harsh environments.**
- **CE Approved.**
- **FCC Conformity Class B**
- **cULus Listed - Class I/Division 2 - Haz. Loc., ATEX, & IECEx.**

Application

For additional information on these devices and related topics, please visit our web site at www.acromag.com and download our whitepaper 8500-904, Introduction to Two-Wire Transmitters.

These dual channel transmitters are designed for high-density mounting on T-type DIN rails. Channel pairs may be mounted side-by-side on 17.5mm centers.

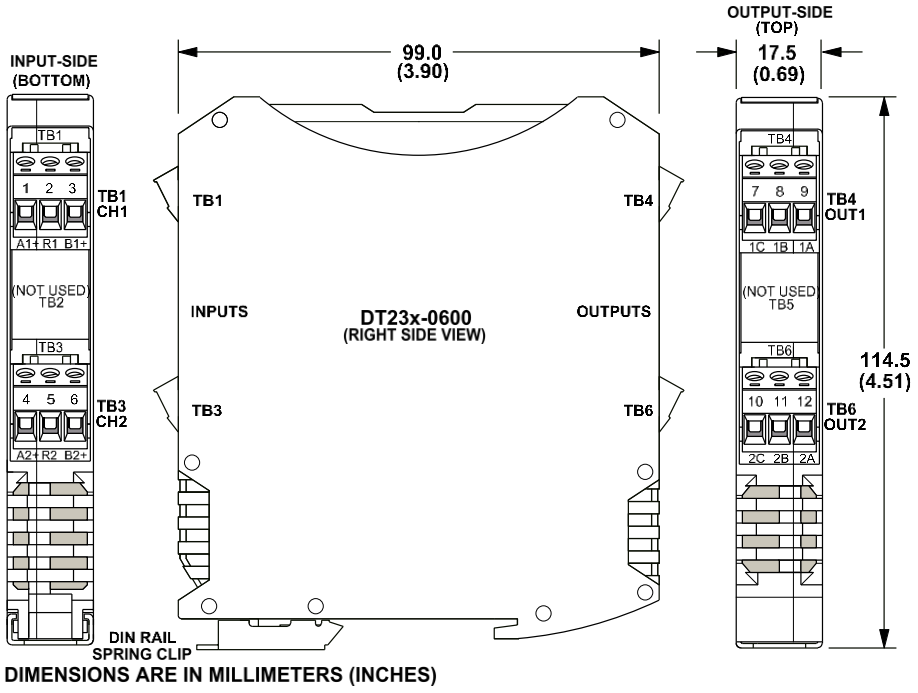
Models support several input ranges on two isolated channels of current or voltage input and mate with grounded or non-grounded sensors. Each channel drives an isolated 4-20mA output current loop linearly with input current or voltage.

The transmitter output signals are two-wire, 4-20mA current loops, allowing the unit to transmit over long distances with high noise immunity. The inherent live-zero 4mA offset loop current offers built-in output fault detection if an output wire should break. An extra connection screw at each output channel allows it to be optionally wired for a "sourced" 4-20mA output configuration (see Optional Output Wiring diagram).

Mechanical Dimensions

Units may be mounted to 35mm "T" type DIN rail (35mm, type EN50022), and side-by-side on 0.69-inch centers.

WARNING: *IEC Safety Standards may require that this device be mounted within an approved metal enclosure or sub-system, particularly for applications with exposure to voltages greater than or equal to 75VDC or 50VAC.*



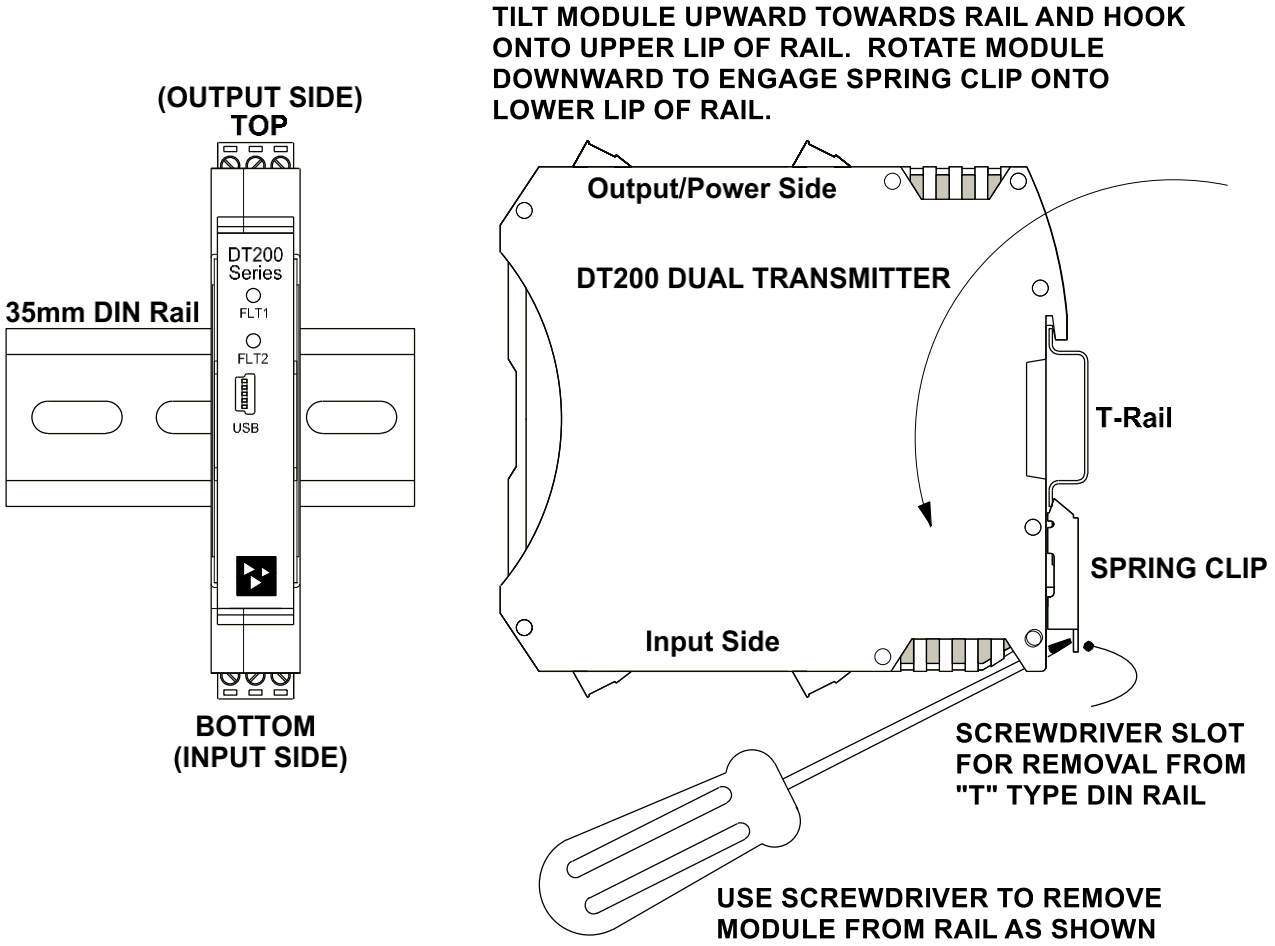
DIMENSIONS ARE IN MILLIMETERS (INCHES)

DIN Rail Mounting & Removal

NOTE: It is recommended that this unit be mounted upright on a DIN rail allowing free air flow intake from the bottom vent to flow through the unit and out the top vent. This will allow the unit to run cooler, improving performance and helping to extend the life of the electronics.

Refer to the following figure for attaching and removing a unit from the DIN rail. A spring-loaded DIN clip is located on the input side bottom. The opposite rounded edge at the bottom of the output side allows you to tilt the unit upward to lift it from the rail while prying the spring clip back with a screwdriver. To attach the module to T-type DIN rail, angle the top of the unit towards the rail and place the top groove of the module over the upper lip of the DIN rail. Firmly push the unit downward towards the rail until it snaps into place. To remove it from the DIN rail, first separate the input terminal blocks from the bottom side of the module to create a clearance to the DIN mounting area. You can use a screwdriver to pry the pluggable terminals out of their sockets. Next, while holding the module in place from above, insert a screwdriver into the lower path of the bottom of the module to the DIN rail clip and use it as a lever to force the DIN rail spring clip down while pulling the bottom of the module outward until it disengages from the rail. Then simply lift it from the rail.

DT23x DUAL TRANSMITTER DIN RAIL MOUNTING AND REMOVAL



ELECTRICAL CONNECTIONS

WARNING – EXPLOSION HAZARD – Do not disconnect equipment unless power has been removed or the area is known to be non-hazardous.
WARNING – EXPLOSION HAZARD – Substitution of any components may impair suitability for Class I, Division 2.
WARNING – EXPLOSION HAZARD – The area must be known to be non-hazardous before servicing/replacing the unit and before installing.

Wire terminals can accommodate 14–28 AWG (2.08–0.081mm^2) solid or stranded wire with a minimum temperature rating of 90^{o}C. Input wiring may be shielded or unshielded type. Ideally, output wires should be twisted pair, or shielded twisted pair. Terminals are pluggable and can be removed from their sockets by prying outward from the top with a flat-head screwdriver blade. Channels support two input paths A & B at TB1 (channel 1) and TB3 (channel 2), each for a different nominal range. Strip back wire insulation 0.25-inch on each lead and insert the wire ends into the cage clamp connector of the terminal block. Use a screwdriver to tighten the screw by turning it in a clockwise direction to secure the wire (0.5-0.6 Nm torque). Since common mode voltages can exist on signal wiring, always use adequate wire insulation. And as a rule, while output wires are normally separated from input wiring for safety, this is equally important for low noise pickup.

Important – End Stops: For hazardous location installations (Class I, Division 2 or ATEX/IECEx Zone 2), it should utilize two end stops (see Acromag 1027-222) to help secure modules to the DIN rail (not shown).

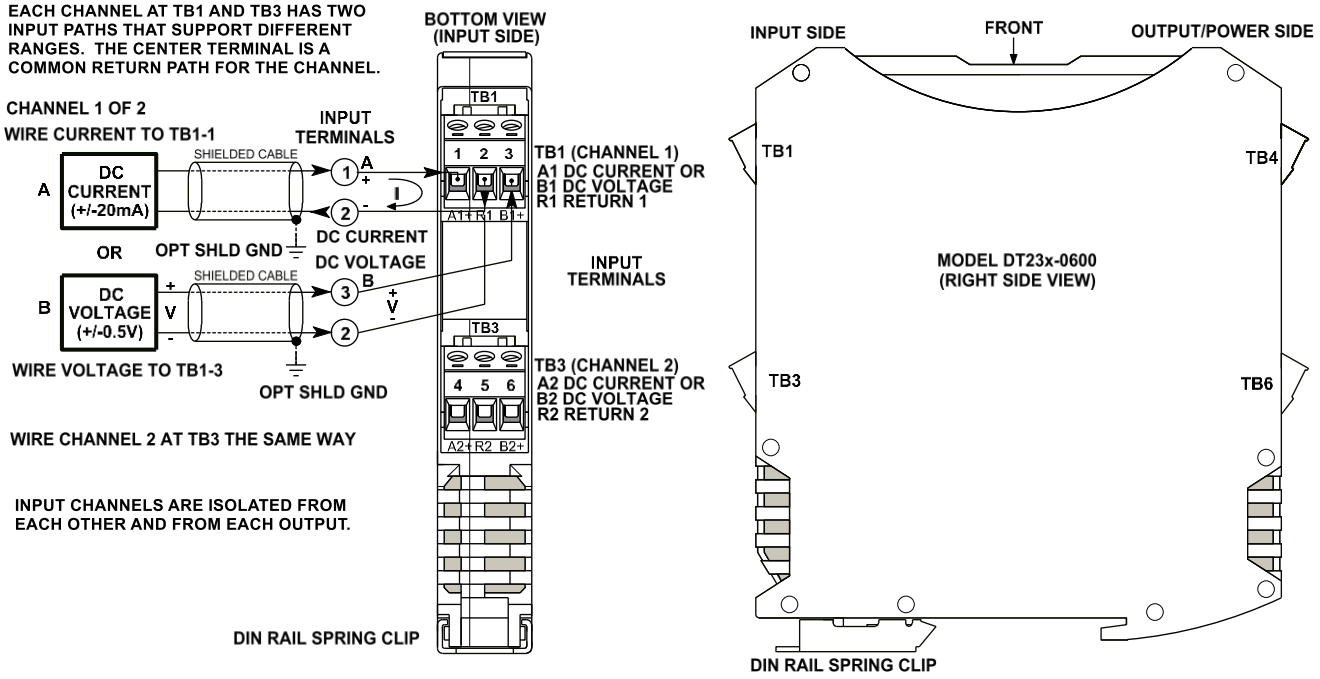
Input Connections

Note: This transmitter may operate as a single channel 1 transmitter, a dual transmitter, or a channel 1 signal splitter. You must apply loop power to output 1 to operate this transmitter in any mode.

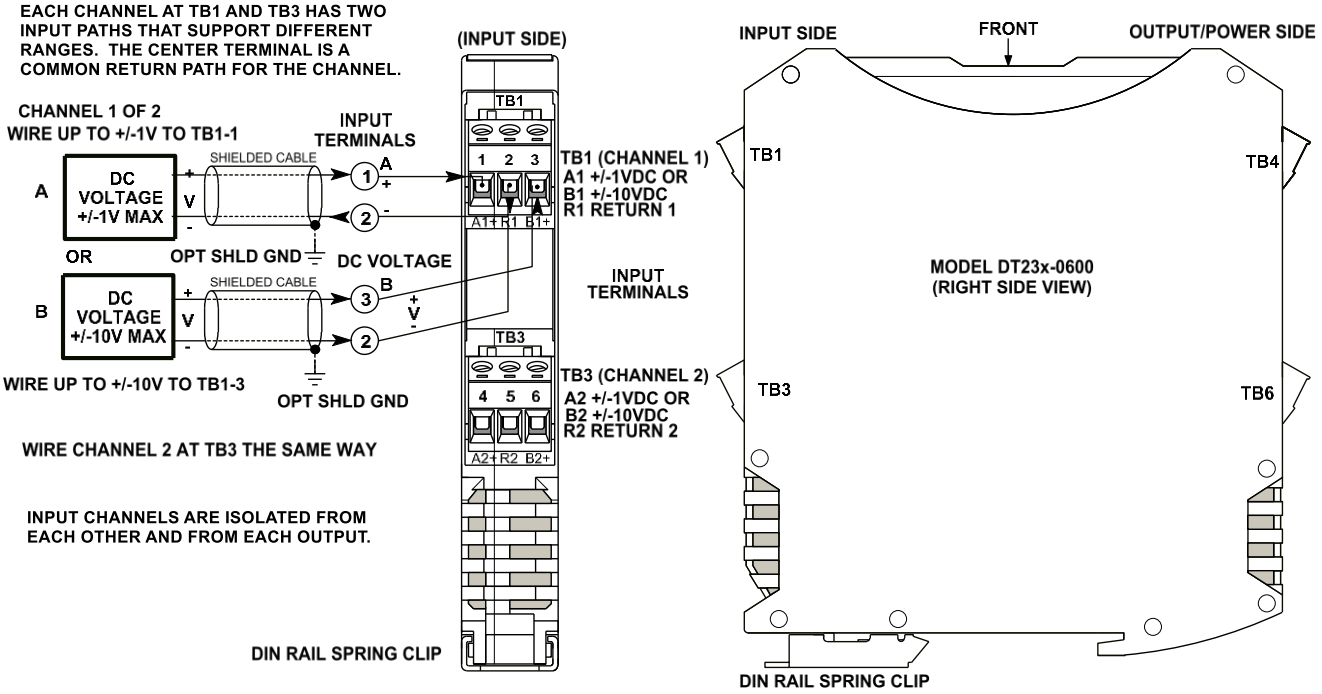
Sensor wires are wired directly to transmitter input terminals TB1 and TB3 at the bottom of the module (the spring-loaded DIN clip side), as shown in the connection drawing on next page. Observe proper polarity when making input connections.

- **Separate transmitter inputs at TB1 and TB3 are isolated from each other and from outputs at TB4 and TB6**. As a single transmitter, input is to TB1/channel 1 and output/power are wired to TB4/output 1. As a signal splitter, input is to TB1/channel 1 and transmitted to both outputs at TB4 and TB6.
- **Inputs are polarized ±, observe proper polarity.** The left and right outer terminals of terminal blocks TB1 and TB3 are positive input paths for different ranges labeled "+". The middle terminal is the common return path for both signal paths. See connection figure below per input model.
- DT236 wires ±20mA DC Current to the leftmost terminal of TB1/TB3 and ±0.5VDC to the rightmost terminal of TB1/TB3. The return for these signal paths is the middle terminal of TB1/TB3.
- DT337 wires ±1V DC maximum to the leftmost terminal of TB1/TB3 and ±10V DC maximum to the rightmost terminal of TB1/TB3. The return for these signal paths is the middle terminal of TB1/TB3.
- DT338 wires ±15V DC maximum to leftmost terminal of TB1/TB3 and ±150V DC Battery Sources maximum to the rightmost terminal of TB1/TB3. The return for these signal paths is the middle terminal of TB1/TB3.

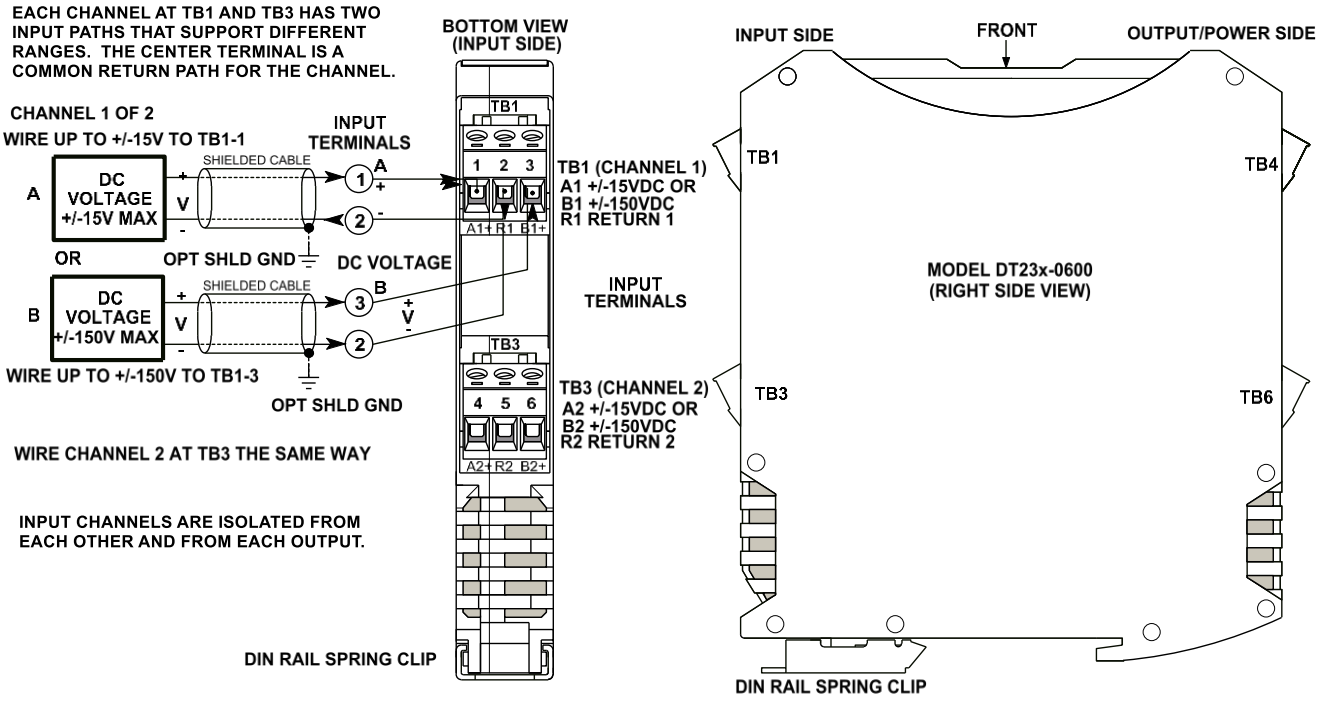
MODEL DT236-0600 INPUT SENSOR WIRING
DC CURRENT AND DC MILLIVOLTAGE INPUT



MODEL DT237-0600 INPUT SENSOR WIRING
MEDIUM DC VOLTAGE INPUT



MODEL DT238-0600 INPUT SENSOR WIRING
HIGH-LEVEL DC VOLTAGE INPUT



Output/Power Connections

NOTE: Because this unit's microcontroller is powered from output 1, you must connect power to output loop 1 to operate this unit in any mode (single transmitter, dual transmitter, and signal splitter). Output loop 2 only powers input 2 and is not used in single channel 1 transmitter mode.

This dual channel transmitter has two isolated ANSI/ISA Type 2 outputs in which the channel's power and output signal share the same two leads or current loop, and each transmitter output has a "floating" connection with respect to earth ground. Connect a DC power supply and load in series in each of the two-wire output loops as shown in the drawings that follow.

- **Passive output connections are not polarized**. The output + and – designations are for reference only with current normally input to Output+ and returned via Output- (current sinking). Output loop 1 powers input 1 & the microcontroller.
- **Loop supply voltages should be from 7-32V DC** with the 7V minimum transmitter voltage level adjusted upward to drive nominal current to the loop load (up to 24mA*R_{load}), plus any transmission line drop.
- **Variation in power supply voltage has negligible effect on transmitter accuracy** between the 7V minimum required by the transmitter and 32V maximum allowed (may drive loads up to 32-7/0.024=1041Ω at 24mA).
- **Variation in load resistance has negligible effect on output accuracy** if the loop supply voltage level is set correctly for the load resistance (see above).
- **Note the traditional placement of earth ground in a two-wire current loop.** The transmitter output is not earth grounded at the transmitter. Output Earth ground is normally applied at the loop power supply minus terminal. The two-wire transmitter output varies off earth ground by the voltage drop in the load resistance and lead-wire of the loop.

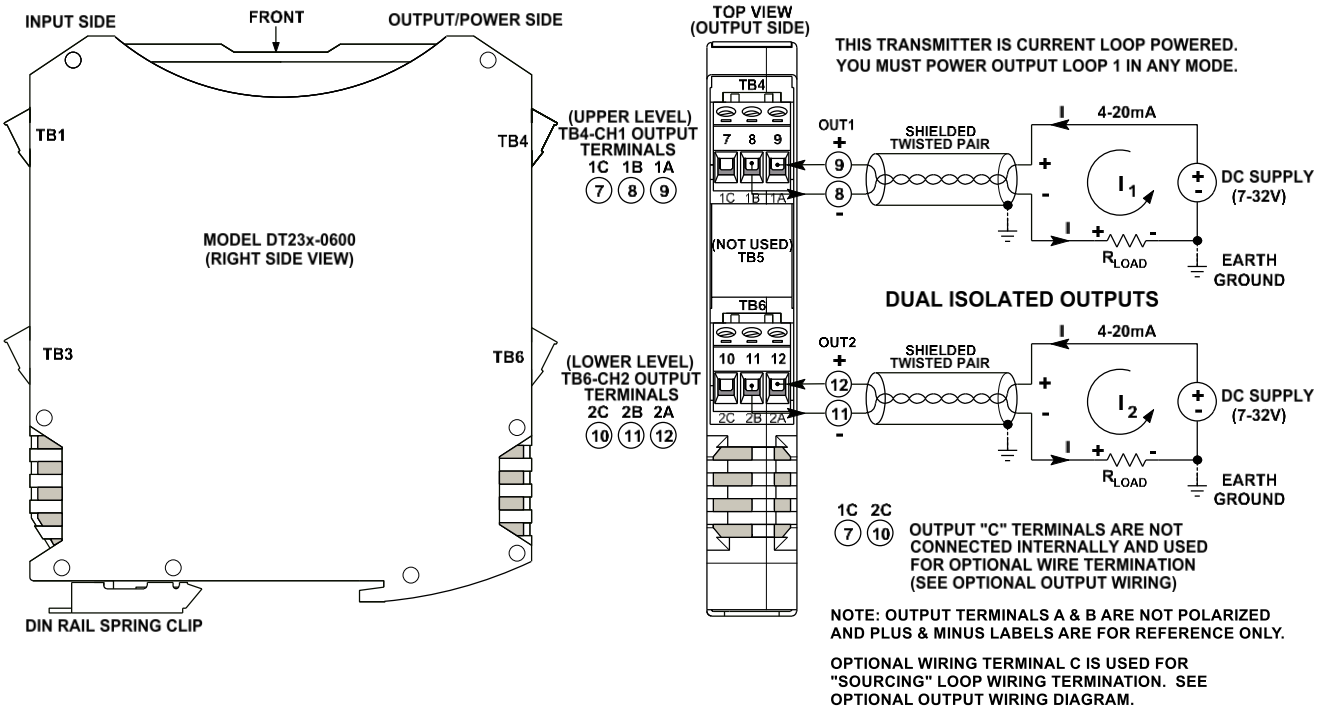
Output/Power Connections…continued

The traditional loop-powered 2-wire "sinking" or passive output connection is shown below. Shielded twisted-pair wiring is often used at the output to connect the longest distance between the field transmitter and the remote receiver of the output loop as shown. Each passive output of this transmitter is isolated and fluctuates relative to earth ground by the voltage drop in its output load and connection wire.

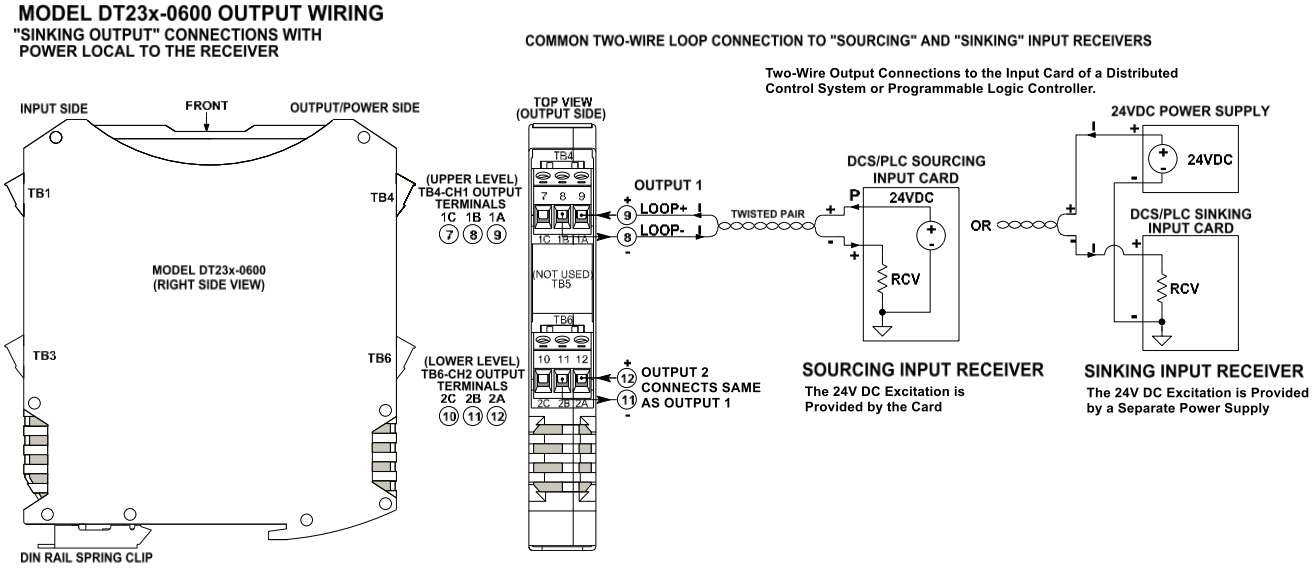
In most installations, the output loop power supply will be local to either the unit, or local to the remote receiver of the output loop. Common receiver devices may include the input channel of a Programmable Logic Controller (PLC), a Distributed Control System (DCS), or a panel meter. Some receiver devices already provide excitation for the transmitter loop and these are referred to as "sourcing" or active inputs. Other receivers that do not provide loop excitation are referred to as "sinking" or passive inputs, and these will require that a separate power supply connect within the loop. These types of receivers are depicted in the figures of the next two pages.

WARNING: For compliance to applicable safety and performance standards, the use of twisted pair output wiring is recommended. Failure to adhere to sound wiring and grounding practices as instructed may compromise safety, performance, and possibly damage the unit.

MODEL DT23x-0600 OUTPUTS/POWER WIRING
TRADITIONAL LOOP-POWERED "SINKING OUTPUT" CONNECTIONS



Output/Power Connections…continued

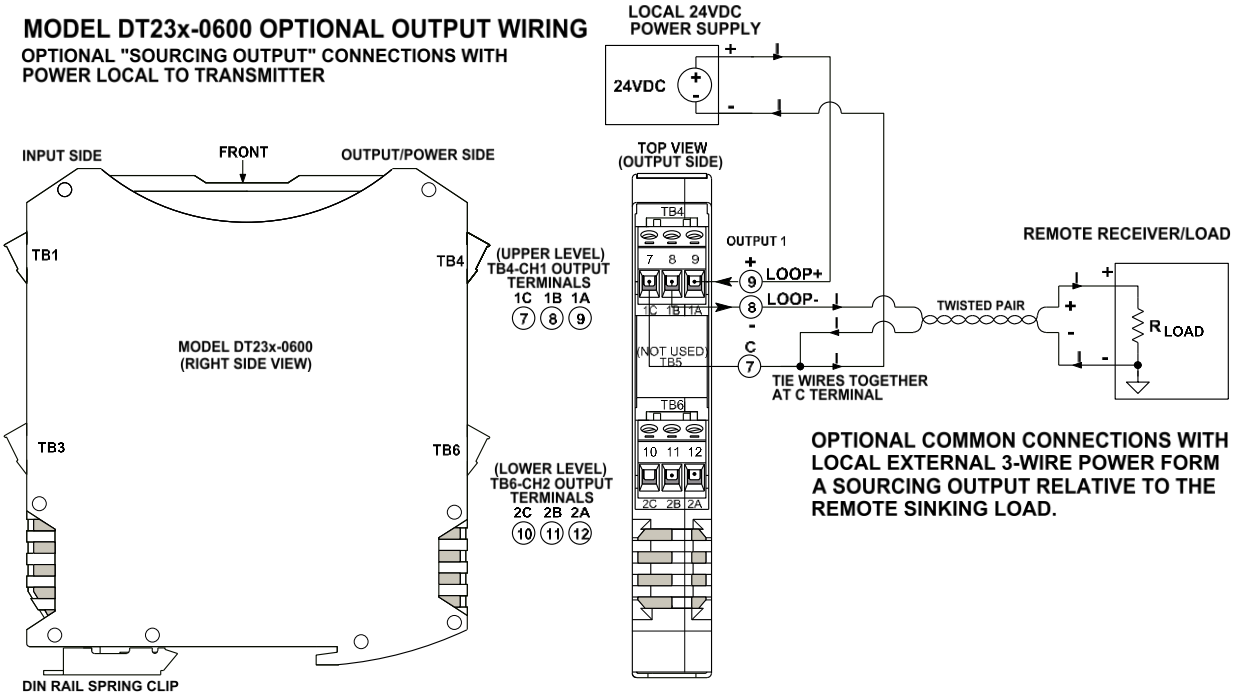


TIP - Ripple & Noise: Place additional capacitance at the load to help reduce the 60Hz/120Hz ripple sometimes present in industrial applications. For large 60Hz ripple, connect an external 1uF or larger capacitor directly across the load to reduce excess ripple. Most modern systems will use high-speed acquisition at the load making them more sensitive to noise pickup--high frequency noise may be significantly reduced for these applications by placing a 0.1uF or 0.01uF capacitor directly across the load, as close to the load as possible (this may also raise RF immunity).

TIP - Inductive Loads: If either two-wire current loop includes a highly inductive load (such as an I/P current-to-pressure transducer), this may reduce output stability for that output. In this case, place a 0.1uF capacitor directly across the inductive load(s) and this will typically help alleviate the problem.

Output/Power Connections…continued

This model includes an extra termination screw marked "C" at each output intended to provide a convenient tie-point for a "sourcing" wiring variation as shown below. The C terminals do not connect to the internal circuit but is used to simply join wired connections. Use of this terminal in your wiring scheme allows you to connect external power local to the transmitter and form a "sourcing" or active entity from this "sinking" or passive output as shown below.



Earth Ground Connections

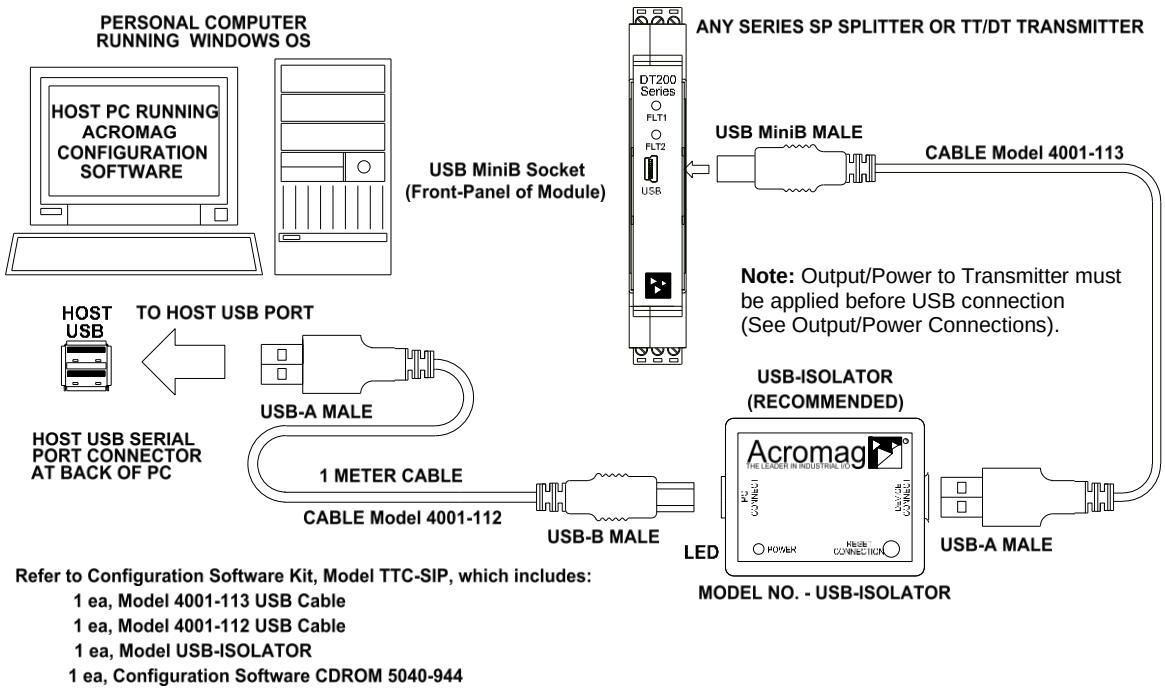
IMPORTANT: A USB isolator is recommended when configuring or calibrating a unit to avoid the ground loop that occurs if your input signal is also earth grounded (A PC commonly ties earth ground to its USB port signal and shield ground, which is held in common to the input circuit ground of this transmitter).

The unit housing is plastic and does not require an earth ground connection to itself. If the module is mounted in a metal housing, an earth ground wire connection to that metal housing's ground terminal (green screw) is usually required using suitable wire per applicable codes. As a rule of good practice, isolated circuits are normally earth grounded at only one point. Circuits wired to isolated analog inputs should be earth grounded as reflected in their input connection diagram. See the Electrical Connections Drawing for Output/Power connections and note the traditional position of earth ground for a two-wire output current loop--earth ground is normally applied at the output loop power supply minus terminal and held in common with the loop load or loop receiver minus terminal (not the transmitter output terminal). These type II transmitter output terminals have a "floating" connection relative to earth ground and their potential varies with the voltage drop in the load and connection wire. Ground connections noted are recommended for best results and help protect the unit and its isolated circuitry by giving it a low impedance path to ground for shunting destructive transient energy away from sensitive module circuitry. Respect the traditional position of earth ground in a two-wire current loop and avoid inadvertent connections to earth ground at other points in the same loop, which would drive ground loops and negatively affect operation.

USB Connections

This transmitter is set up, configured, and calibrated with USB software that runs on a USB-connected Windows-based PC (Windows 7 or later), or via our Agility mobile APP installed on a compatible Android tablet or smartphone connected via a USB-OTG cable. Refer to the drawing below to connect your PC or laptop to the transmitter for reconfiguration and calibration using this software (the optional connection to an Android smartphone/tablet would not usually require the use of an isolator, because those devices are battery powered and do not make another connection to earth ground).

DT SERIES DUAL USB TRANSMITTER CONNECTIONS
USED FOR CONFIGURATION AND CALIBRATION OF THE TRANSMITTER IN A SAFE OR ORDINARY LOCATION



Refer to Configuration Software Kit, Model TTC-SIP, which includes:
1 ea, Model 4001-113 USB Cable
1 ea, Model 4001-112 USB Cable
1 ea, Model USB-ISOLATOR
1 ea, Configuration Software CDROM 5040-944

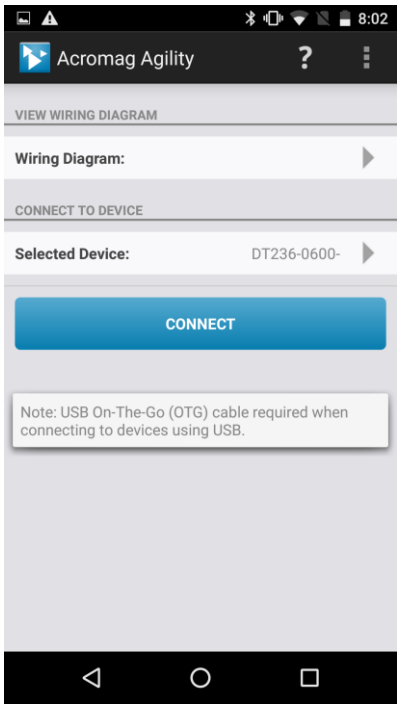
WARNING: The intent of mating USB with this transmitter is so that it can be conveniently set up and calibrated in a safe area, then installed in the field which may be in a hazardous area. Do not attempt to connect a PC or laptop to this unit while installed in a hazardous area, as USB energy levels could ignite explosive gases or particles in the air.

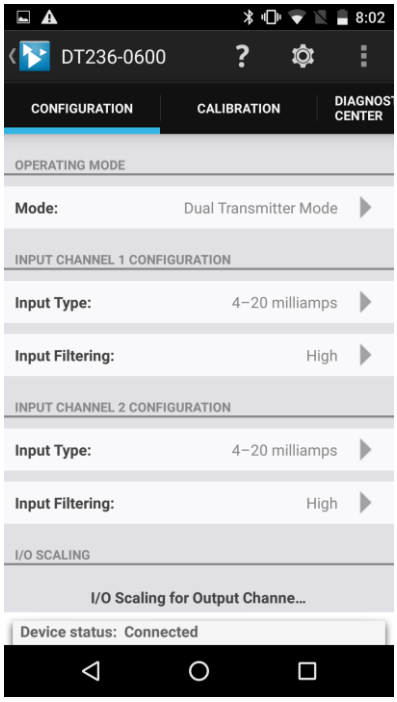
- **USB Signal Isolation is Required (See Below) -** You may use Acromag model USB-ISOLATOR to isolate your USB port, or you can optionally use another USB signal isolator that supports USB Full Speed operation (12Mbps).
- **Configuration Requires USB <u>and</u> Loop Power** - This transmitter draws power from both the current loop and from USB during set up.

IMPORTANT: USB signals to this unit are referenced to the potential of its internal input 1 signal common which connects to the USB ground and shield ground, and why we recommended you isolate USB to this device, or alternatively connect it to a battery powered laptop with no earth ground connection. This would avoid a potential ground loop between your PC and a grounded input 1 sensor. As a two-wire device, the current output terminal is not earth grounded and its potential relative to earth ground varies with the loop current through the load resistance (net IR drop). Without isolation, the load IR drop would drive a potential difference between the normally grounded current loop and a grounded USB connection at the PC, causing a ground loop that would inhibit set up & calibration, or may even damage the transmitter.

CONFIGURATION SOFTWARE

Quick Overview – Android Reconfiguration





This transmitter can be optionally setup & calibrated via the Acromag Agility™ Config Tool. This software APP can be downloaded free of charge from play.google.com. To connect to this transmitter, a USB OTG (On-The-Go) cable (5028-565) and USB A to Mini-B cable (4001-113) are required. This app is compatible with Android devices using Ice Cream Sandwich (4.0) or later.

The initial Connection screen of the app is shown at left. Once a device is connected, the main portion of the app will launch. Briefly, the APP screen is divided into four tabs for this model. A short description of each tab follows.

Initial Connection Screen Set up – DEVICE SELECT (First Connect to Unit Here)

- Select from connected transmitters by tapping the **[Select Device]** button to bring up a list of attached devices. Select a device and tap **[Connect]** to open the device.
- To view wiring diagrams for this model, tap the **[Wiring Diagram]** button and select the desired model. Swipe left or right to view a connection drawing (note that no connection is required to just view drawings).
- Android devices normally require user permission to access external hardware. If "No Device Permission" is indicated in the Device List, select this device and when prompted, grant permission to access the USB device and tap **[OK]**.

Configuration Tab – (Setup your I/O)

- Once connected, the app will automatically read your transmitter, its mode, and display its current configuration.
- Changing any option on this page will send the changes to the transmitter instantly. The device status field at the bottom of the page will report if the changes were sent successfully.

Calibration Tab – (Calibrate the Input and/or Output if Needed)

- On screen instruction guides the set up to properly calibrate a transmitter channel input or output. After completing instructions, tap the **[Calibrate]** button.
- The device status at the bottom of the page will report if the calibration was sent successfully.

Diagnostic Center Tab – (Verify Input operation)

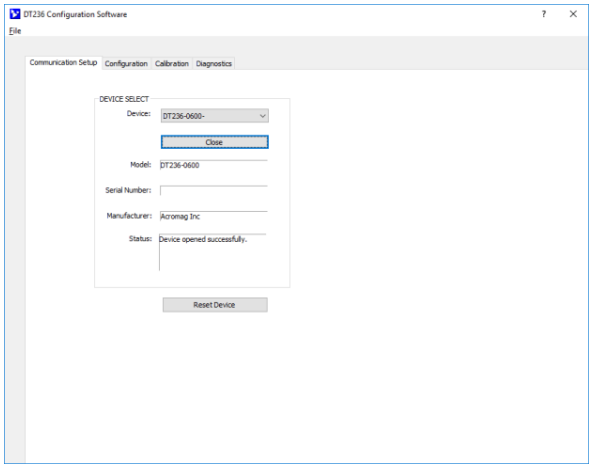
- Select the polling indicator by tapping the **[Indicator]** button.
- Start polling by tapping the **[Start Polling]** button.

Utility Page – (Reboot or Restore Settings)

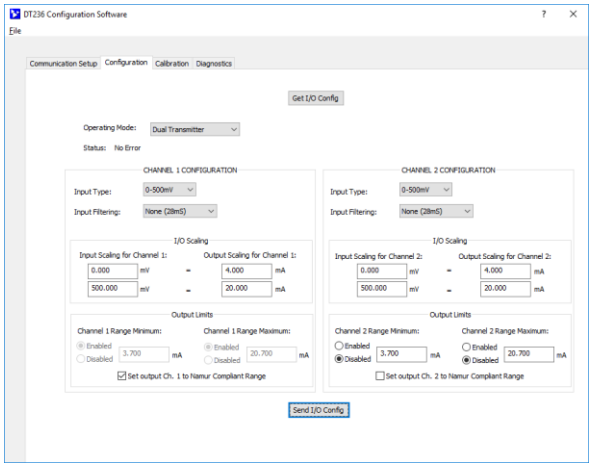
- Tap the **[Gear]** in the Action bar to access the Utility Page.
- You can tap the **[Restore/Reset Factory]** utility buttons to get out of trouble if you ever misconfigure or improperly calibrate a transmitter.

Quick Overview – Windows

*Click **"Open"** to connect to the DT236-0600 and your screen will look like this:*



After connecting to the DT236-0600, you may click the Configuration tab to display this screen:



For detailed configuration and calibration procedures, see the Operation Step-By-Step section of the Technical Reference on page 23 of this manual.

HELP – You can press F1 for Help on a selected or highlighted field or control. You can also click the [?] button in the upper-right hand corner of the screen and then click again to point to a field or control to get a Help message pertaining to the item you pointed to.

In addition to the optional Android Agility mobile app, this transmitter can be configured and calibrated via USB Configuration Software and a USB connection to a Windows PC or laptop. The configuration software can be downloaded free of charge from our web site at https://www.acromag.com. This software is also included on a CDROM bundled with the Configuration Kit TTC-SIP (see Accessories section). For the DT236 model, look for program DT236Config.exe. This software is compatible with Windows 7 or later versions of the Windows operating system.

Communication Setup– First Select/Connect to Unit Here

The initial Communication Setup screen for the DT236 model is shown at left after clicking **[Open]** to open communication with a connected module.

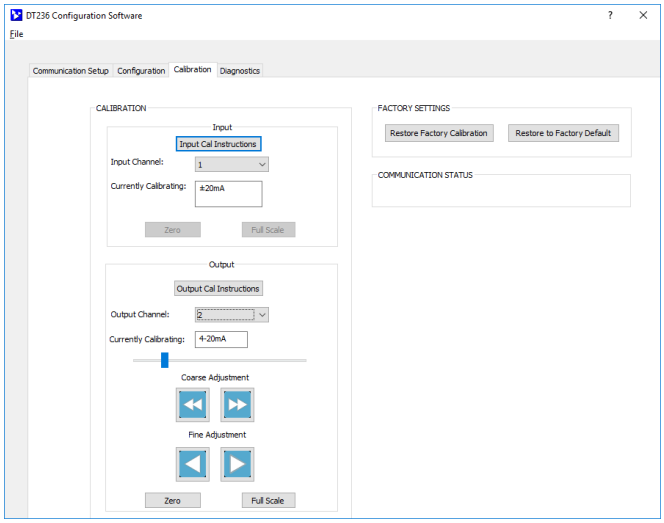
- Select from connected transmitters using the Device scroll field and Open/Close communications with them.
- Display Model, Serial Number, & Manufacturer of the transmitter, report its connection Status, or Reset it.

Configuration – Reconfigure the Unit Here

The DT236-0600 Configuration screen is shown at left.

- Click **[Get I/O Config]** to retrieve the I/O configuration of the connected unit.
- Select the Operating Mode: Dual Transmitter, Single transmitter, or Signal Splitter.
- View the config message status in the Status field.
- View the unit's communication status in the Status field.
- Select each CH Input Type/Range. For DT236, you can select current of ±20mA, 0-20mA, 4-20mA, 0-11.17mA, or ±1mA for input A, or voltage ranges of ±0.5V and 0-500mV for input B.
- Set the level of digital filtering to High, Medium, Low, or None (No digital filter). I/O response times vary with filter and are indicated next to your selection.
- Use I/O Scaling fields to specify the input range endpoints to map to the output range zero and full-scale endpoints (some over/under-range is always included).
- Set your own output operating range limits or enable Namur limits that differentiate fault levels from over/under range detents.
- Last, after making I/O changes, send your settings to the unit by clicking the **[Send I/O Config]** button and following the on-screen prompts.

Quick Overview – Windows...



HELP – You can press F1 for Help on a selected or highlighted field or control. You can also click the [?] button in the upper-right hand corner of the screen and then click again to point to a field or control to get a Help message pertaining to the item you pointed to.

Calibration (Input or Output)

- Calibrate an input or output channel, as needed.

This unit has already been factory calibrated. If you encounter excessive error, you can choose to click the Calibration tab to display the Calibration control page shown in the screen at left. Note that only nominal I/O ranges are used for calibration, not the scaled down sub-ranges you may have set.
To calibrate an Input or Output channel of this model, simply select the channel click the respective "Cal Instructions" button and follow the on-screen prompts.

Input…
Before attempting input calibration, first set the Input Range and its filter level from the Configuration page as required before calibrating the input and be sure to click the **[Send I/O Config]** button of the Configuration page.

Click **[Input Cal Instructions]** to begin input calibration. Next when you click input **[Zero]** or **[Full Scale]**, you will be prompted to apply a specific input level at TB1 (CH1), or TB3 (CH2), depending on your selected input range. Once you have applied this signal to the correct input terminal, click **[OK]** of the prompt and follow the on-screen instructions to complete input calibration.

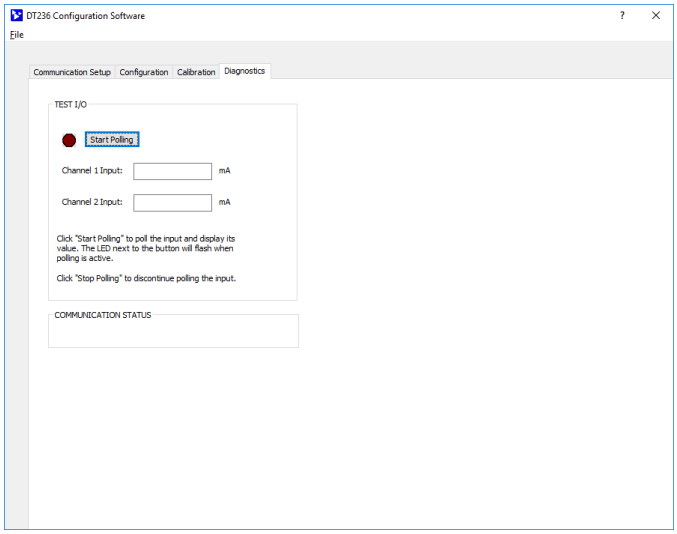
Output…
Click **[Output Cal Instructions]** to begin output calibration. You will be prompted to adjust the input as required to drive the output to precisely 4.000mA (Zero), or 20.000mA (Full-Scale). Once the output is set to zero or full-scale, you simply click the corresponding **[Zero]** or **[Full-Scale]** button of the CALIBRATION - Output to set the output range zero or full-scale endpoint.

Factory Settings
(Use in Case of Trouble or for Sanitation Purposes)

- Restore a transmitter to its original factory calibration.
- Restore a transmitter to its initial factory configuration.

You can click the "Restore Factory" buttons if you ever misconfigure or improperly calibrate a transmitter such that its operation appears erratic, or for sanitation purposes when decommissioning a module.

Quick Overview – Windows...



HELP – You can press F1 for Help on a selected or highlighted field or control. You can also click the [?] button in the upper-right hand corner of the screen and then click again to point to a field or control to get a Help message pertaining to the item you pointed to.

Diagnostics (Optional, to Verify Unit Operation)

After making Configuration changes, you may use the Diagnostics - TEST I/O controls to start/stop polling the input channel(s) to check your input readings (see screen at left).

- Use this screen to verify communication with the unit or diagnose problems with your input wiring.
- Click **[Start Polling]** to periodically read both input channels and validate their operation. Click **[Stop Polling]** to stop polling the input channels. The simulated red lamp to the left of the button flashes slowly when the software polls the input channels. Stop polling before selecting another page or sending a new reconfiguration.

The communication status of the polling messages is also indicated and can be helpful to troubleshoot connection problems.

Communication (Bottom of Screen)

- Displays communication status messages for the polling process.

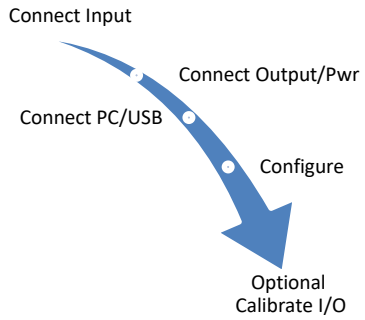
The CCOMMUNICATION STATUS message bar at the bottom of the screen will display status messages relative to polling.

TECHNICAL REFERENCE

OPERATION STEP-BY-STEP

Connections

This section will walk you through the Connection-Configuration-Calibration process step-by-step. But before you attempt to reconfigure or recalibrate this transmitter, please make the following electrical connections

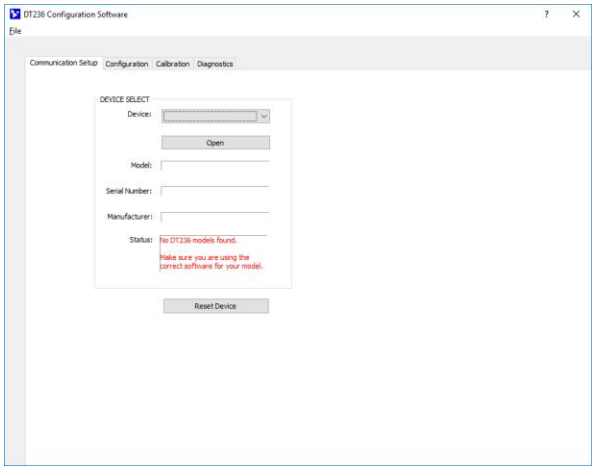


Note: For best results, your input signal source and output meter must be accurate beyond the unit specifications, or better than ±0.1%. A good rule of thumb is to ensure that your equipment accuracy be four times better than the rated accuracy you are trying to achieve with this transmitter (i.e. ±0.025% accurate to achieve ±0.1% accuracy).

1. **Connect Input:** Refer to Input Connections Drawings on page 7-9 for your model. Note that each channel has two input paths, each supporting a different nominal range. For DT236 models at TB1/TB3, connect a precision current source to path A, or a precision voltage source to path B, as applicable to your selected range (signal return is the middle terminal). Your signal source must be adjustable to nominal range zero and full-scale values.
2. **Connect Output/Power (each Output):** Refer to Output/Power Connection of page 10 and wire an output current loop to the transmitter as illustrated (both loops if you are using both channels with the unit in splitter or dual transmitter mode). All modes must connect power to output 1, which drives power to the unit microcontroller. You will need to measure the output current accurately at each output to calibrate the unit. You could connect a current meter in series in each output loop to read the loop current directly (not recommended). Alternatively, you could simply connect a voltmeter across a series connected precision load resistor in each loop, and accurately read the output current as a function of the IR voltage drop produced in the resistor (recommended). In any case, be sure to power each loop with a voltage that is minimally greater than the 7V required by the transmitter, plus the IR drop of the wiring and terminals, plus the IR drop in the load (be sure to use a current level that considers the over-scale current as follows: Loop Voltage= 7V+ 0.024*Rload with negligible line drop). In this model, output channel 1 powers the unit's microcontroller and input channel 1 while output channel 2 only powers input channel 2. Always apply power to at least output loop 1, even when connected to USB.
3. **Connect to PC via isolated USB:** Refer to USB Connection Drawing on page 13 and connect the transmitter to the PC using a USB isolator and cables provided in the Configuration Kit TTC-SIP. Optionally, you could instead connect the unit to an Android smartphone or tablet running the Agility mobile app uses a USB-OTG cable.

   Now that you have made your input, output/power, and USB connections, and applied power to your output loop(s), you can execute the DT236Config.exe, DT237Config.exe, or DT238Config.exe software per your transmitter model to begin configuration of your unit (compatible with Windows 7 or later versions of the Windows operating system), or you may start the Agility mobile app (Android only).

Configuration

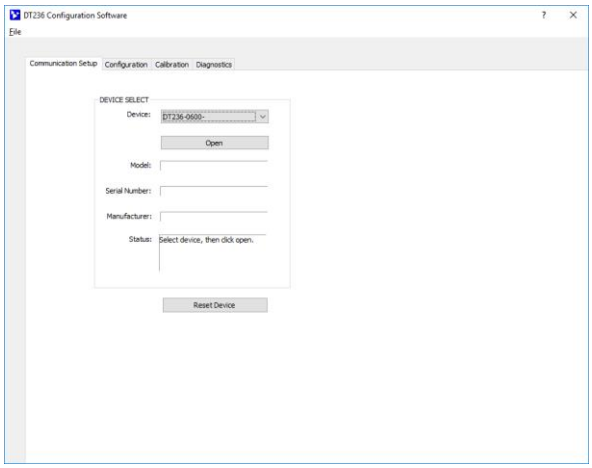


Communication Connection (Start Here)

After executing the Acromag Configuration software for your specific model, a Communication Setup screen like that shown at left will appear **if you have not already connected to your transmitter via USB** (note fields are blank and a red status message appears).

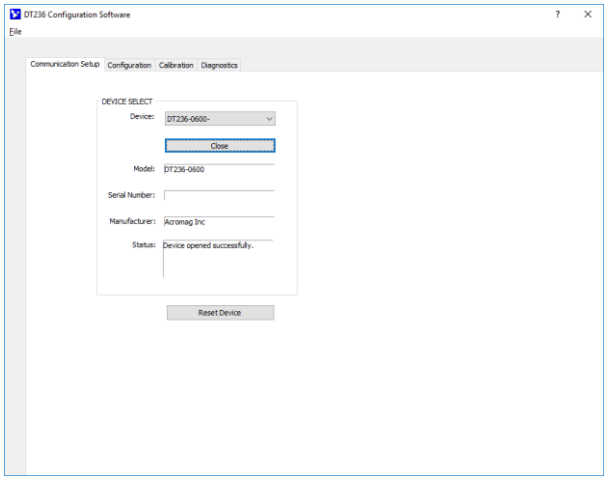
Connect your Windows PC to the unit via isolated USB and its model-serial information will appear in the Device select scroll field as shown in the second screen at left.

Note that if you have a connection path to more than one unit via a USB hub, you can use the Device scroll field to select a different unit using the serial number suffix of the Device Model to discern one unit from another.



Once you have selected a device/serial, click the **[Open]** button to open communication with the unit.

After clicking **[Open]**, the selected unit's Model, Serial Number, Manufacturer, and connection Status will be displayed as shown in the third screen at left.

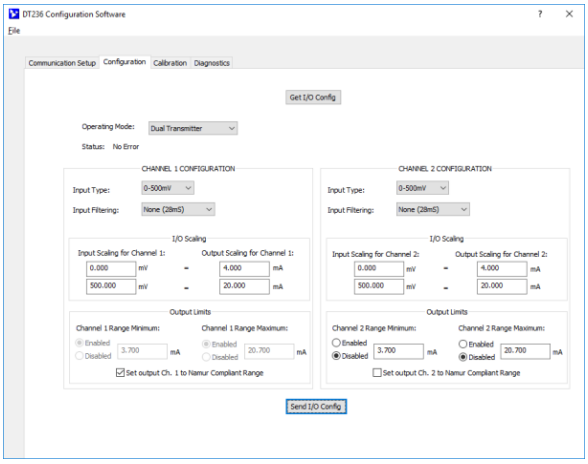


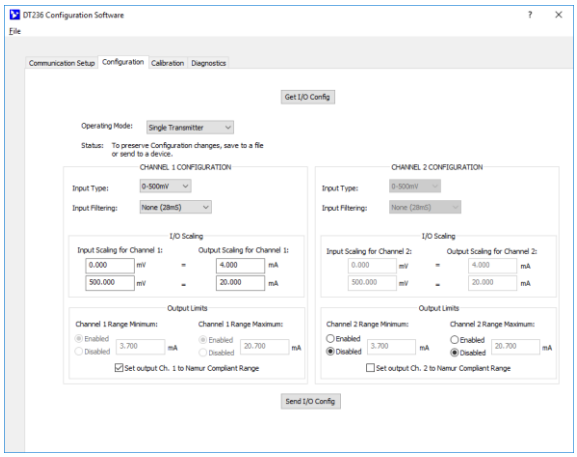
After you connect USB and "Open" communication with a unit, the Status field indicates "Device opened successfully" as shown in third screen at left.

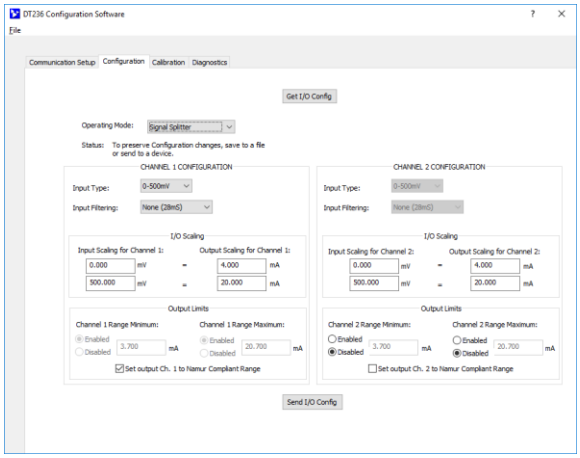
At this point, you can click the "Configuration" tab to begin configuring the unit, "Calibration" to calibrate an input or output channel, or "Diagnostics" to optionally test its operation by polling its input channels.

Note that you must have power connected to output loop 1 of the transmitter in any operating mode, even if connected to USB. If you are in dual transmitter or splitter mode, you must have power connected in both output loops of the unit. You will not be able to configure, calibrate, or test a unit without loop power also applied to at least output 1.

Configuration…continued







Configuration (Setup Unit Here)

IMPORTANT: DT models have three modes of operation: [1]Dual Transmitter, [2]Single Transmitter, and [3]Signal Splitter. The Configuration Screen varies with the Operating Mode selected. The second screen at left is for Single Transmitter mode, the third screen at left is for Signal Splitter mode.

The initial Configuration screen returned represents the connected module's current configuration and operating mode before making changes. Otherwise, you could have loaded the configuration from a saved file, or you may have changed a field. You can always click **[Get I/O Config]** to retrieve the connected module's current configuration at any time.

Note that if you make any changes to the configuration indicated, the only way to preserve the changes is to write them to the device by clicking **[Send I/O Config]**, or to save them to a file by clicking **"File"** in the upper left-hand corner of the screen.

NOTE: Note that each channel of these dual transmitter models has two input paths that differ by the nominal range supported. For the DT236, the first input path A is at TB1-1/TB3-1 (leftmost terminal of TB1/TB3) and intended for DC current only. The second input path B is at TB1-3/TB3-3 (the rightmost terminal of TB1/TB3) and intended for DC voltage only. For both the DT237 & DT238 models, each input path supports a different range of DC voltage input for the channel. Your input range selection will determine which terminal you must wire your input to. Note that the center terminal is always the channel signal return for both input paths.

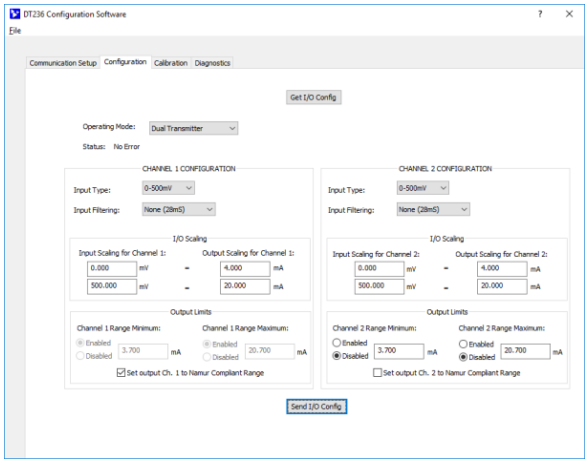
Select the Operating Mode...

The DT transmitters are quite versatile in that they support three different operating modes: Dual Transmitter, Single CH1 Transmitter, and CH1 Signal Splitter. You can change its mode of operation at any time to suit your application

Select the Input Type/Range…

Input Type refers to the nominal input range. Different Input ranges may use different signal paths (see NOTE above). The first terminal A of a DT236 channel supports DC current (TB1/TB3-1) of ±20mA, 0-20mA, 4-20mA, 0-11.17mA, and ±1mA. Its third terminal B (TB1/TB3-3) supports DC voltage ranges of ±0.5V, 0-500mV. The first and third terminals of the DT237 & DT238 models (TB1/TB3-1 and TB1-3/TB3-3) each support different nominal DC voltage ranges. Signal return is wired to the middle terminal between them (TB1/TB3-2).

Configuration…continued



HELP – You can press **[F1]** for Help on a selected or highlighted field or control. You can also click the **[?]** button in the upper-right hand corner of the screen and click to point to a field or control to get a Help message pertaining to the item you pointed to.

If the scaled input/output zero and full-scale points are chosen too close together, performance will be degraded.

Ranges indicated are nominal and may be rescaled to the output, such that you may use only a portion of the input range to drive the transmitter current or voltage output. Because rescaling it smaller will proportionally decrease its resolution, you should be careful to avoid going smaller than 12-bits to achieve rated performance. Each halving of the nominal range will reduce resolution by 1 bit. Decreasing range resolution can magnify error, especially noticeable for very small input ranges which degrade the input signal-to-noise ratio and the resolution of the analog-to-digital input conversion.

Select the Input Filtering…

You may select the level of digital filtering to apply to the input channel as Low, Medium, High, or None (No digital filtering). The respective I/O response times are indicated in parenthesis next to your filter selection. Always set the input filter as desired before calibrating an input. Note that higher filter levels result in lower average noise, but with slower I/O response times.

Set the Scaled I/O Sub-Range Zero & Full-Scale Endpoints…

You may rescale a selected input and/or output range differently for each channel and use a smaller portion of their nominal ranges to drive an input to the output. Be careful as you scale ranges not to reduce the nominal range too much, as resolution will be proportionally diminished and I/O channel noise/error will be magnified (each halving of the nominal range reduces its respective resolution by 1 bit).

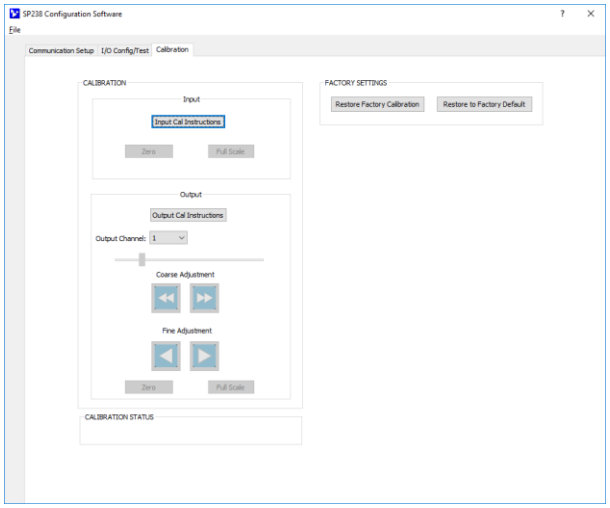
In the Input Scaling fields for input and output, set the input signal minimum/zero value inside its full range to correspond to the output range minimum/zero value (4mA). Set the input signal maximum/full-scale value inside its full range to correspond to the output range maximum/full-scale value (20mA). You can optionally swap input levels to configure a reverse acting output response if you desire. Note that some under and over-range is built into every I/O range selection and these limits vary by range.

Select the Output Limits...

Two-Wire transmitter channels drive current. You can set your own Minimum and Maximum linear operating range limits, or you may select Namur limits of 3.7mA and 21.7mA. By setting range limits inside the a widest possible range from 3.5mA to 24mA, you can discern a valid high or low input signal from a range fault (broken lead or open sensor).

Once you have made your configuration selections, click **[Send I/O Config]** to write them to the module. Read the Status of your configuration transmission in the "Status" field. Alternately, you may click **"File"** in the upper left corner to save your configuration settings to a file on your PC, for later reference.

Calibration (Optional)



CAUTION-Input Calibration: You must input values within your selected input range. Only nominal range endpoints are calibrated, not your scaled sub-range endpoints. Driving input levels outside of the selected input range will not be acceptable for calibration of zero or full-scale. Since input levels cannot be validated during field calibration, incorrect signal levels will produce an undesired output response.

This unit has already been factory calibrated. If you have configured your unit and encounter excessive error, you can click the Calibration tab to display the Calibration control page shown at left.

IMPORTANT: This unit has already had its input and output channels factory calibrated with a high level of precision. If you attempt to recalibrate an input or an output channel, you could degrade its performance if you do it improperly, or you use lower grade equipment. Consider your decision to recalibrate carefully.

Calibration of this transmitter is a two-part process initiated by clicking the respective Input or Output **[...Instructions]** button to get started and following the on-screen prompts that guide you through the process.

CALIBRATION - Input

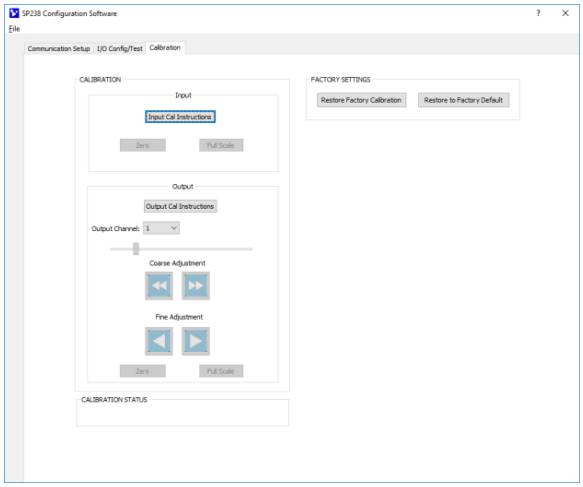
*Before attempting to recalibrate the input, first set the Input Range to calibrate from the "I/O Config/Test" page. Additionally, make sure you write your selections to the unit by clicking the **[Send I/O Config]** button of that page.*

Click the **[Input Cal Instructions]** button to begin input calibration and enable the Input [Zero] and [Full-Scale] buttons.

For a DT236 example, click the Input **[Zero]** button and you will be prompted to input the minimum value of your selected input range at the appropriate input channel (note that it calibrates nominal range endpoints, not scaled range endpoints). If you have selected a DC Current range, you must drive -20mA, 0mA, 4mA, or -1mA at TB1/TB3-1 (input A of channel 1 or 2), depending on the Input Range selected. If you have selected a DC voltage range, you would drive -0.5V or 0V to TB1/TB3-3 (input B of channel 1 or 2). The software does not use your scaled zero, but the zero of the nominal input range selected. Once you input the zero precisely, click the **[OK]** button of the prompt to calibrate zero and follow the on-screen prompts.

For DT236, click the Input **[Full-Scale]** button and you will be prompted to input the maximum value of your selected input range at the appropriate input channel. If you have selected a DC Current range, this will be 20mA or 1mA at TB1/TB3-1 (input A of channel 1 or 2), depending on the nominal Input Range selected. If you have selected a DC voltage range, this will be 0.5V at TB1/TB3-3 (input B of channel 1 or 2). The software does not use your scaled full-scale endpoint, but the full-scale of the nominal input range selected. Once you input full-scale precisely, click the **[OK]** button of the prompt to calibrate full-scale and follow the on-screen prompts.

Calibration…continued



Note: Input calibration from the factory has all sub-ranges of a nominal input range along an input terminal path calibrated automatically by extrapolating from the calibration of the major range for that path to save time (see Specifications Table 1 and note the ranges that share the same divider and gain setting). One exception is ±1mA of the DT236 where its gain doubles requiring it be calibrated separately from ±20mA. However, you still have the option of calibrating a specific sub-range independent of its major range to increase precision if required, but make sure you always calibrate the smaller input range after its major range to prevent the subsequent re-calibration of a range from stepping on the calibration of a smaller sub-range.

CALIBRATION – Each Output

Click the **[Output Cal Instructions]** button to begin output calibration and enable the Output [Zero] and [Full-Scale] buttons.

First, select Output Channel 1 or 2, then use the course and fine adjustment buttons to adjust the output current to precisely 4.000mA. Be sure to measure this level accurately or performance will be degraded. After driving the output to 4.000mA, click the Output **[Zero]** button of the Calibration Output section to calibrate the output zero level at the channel.

Next, use the course and fine adjustment buttons to adjust the output signal to precisely 20.000mA. Be sure to measure this level accurately or performance will be degraded. After driving the output to 20.000mA, click the Output **[Full-Scale]** button of the Calibration Output section to calibrate the output full-scale level at the channel.

Repeat this process for the second output channel.

If following calibration, your output acts erratic or appears imprecise, you may need to repeat input or output calibration, being very careful to take accurate measurements and drive correct signal levels. If you are measuring voltage across an output load resistance to measure the current level in an output (recommended), make sure that you use exact resistance when calculating the measured loop current.

CALIBRATION STATUS

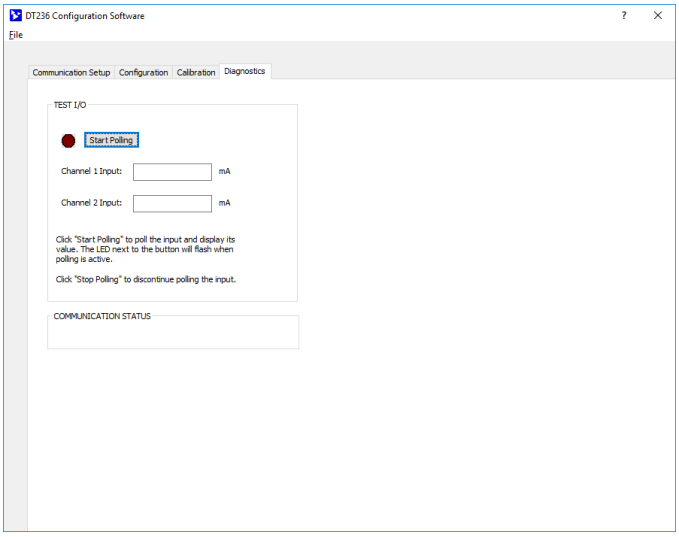
This field displays calibration status messages like “No Error”, “Transfer Error”, and “Timeout Error” during calibration. If you encounter a Transfer or Timeout Error, you should repeat the calibration process.

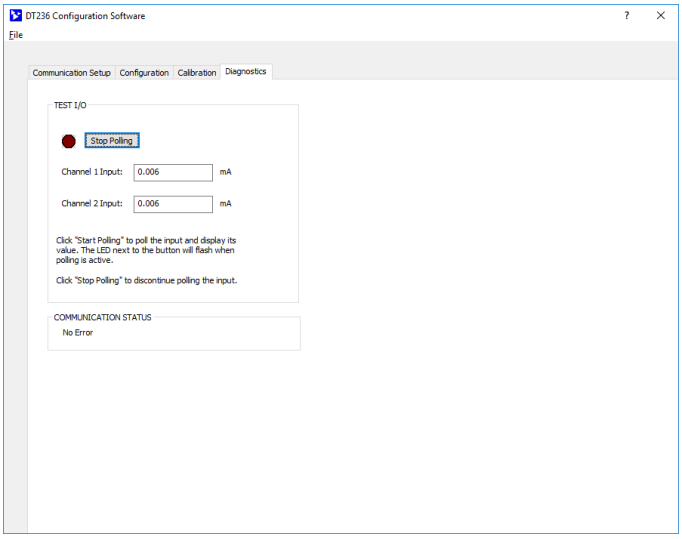
FACTORY SETTINGS

You can use the **[Restore Factory Calibration]** button to restore the transmitter’s original factory calibration if you think you made an error during recalibration, have degraded its performance, or if the I/O channel appears erratic.

You can use the **[Restore to Factory Default]** button to return the unit to its original factory state (see Specifications Reference Test Conditions) and configuration settings. This does not restore calibration, only configuration. Alternately, this button can be used as a sanitation tool to restore the unit to its initial configuration.

Diagnostics





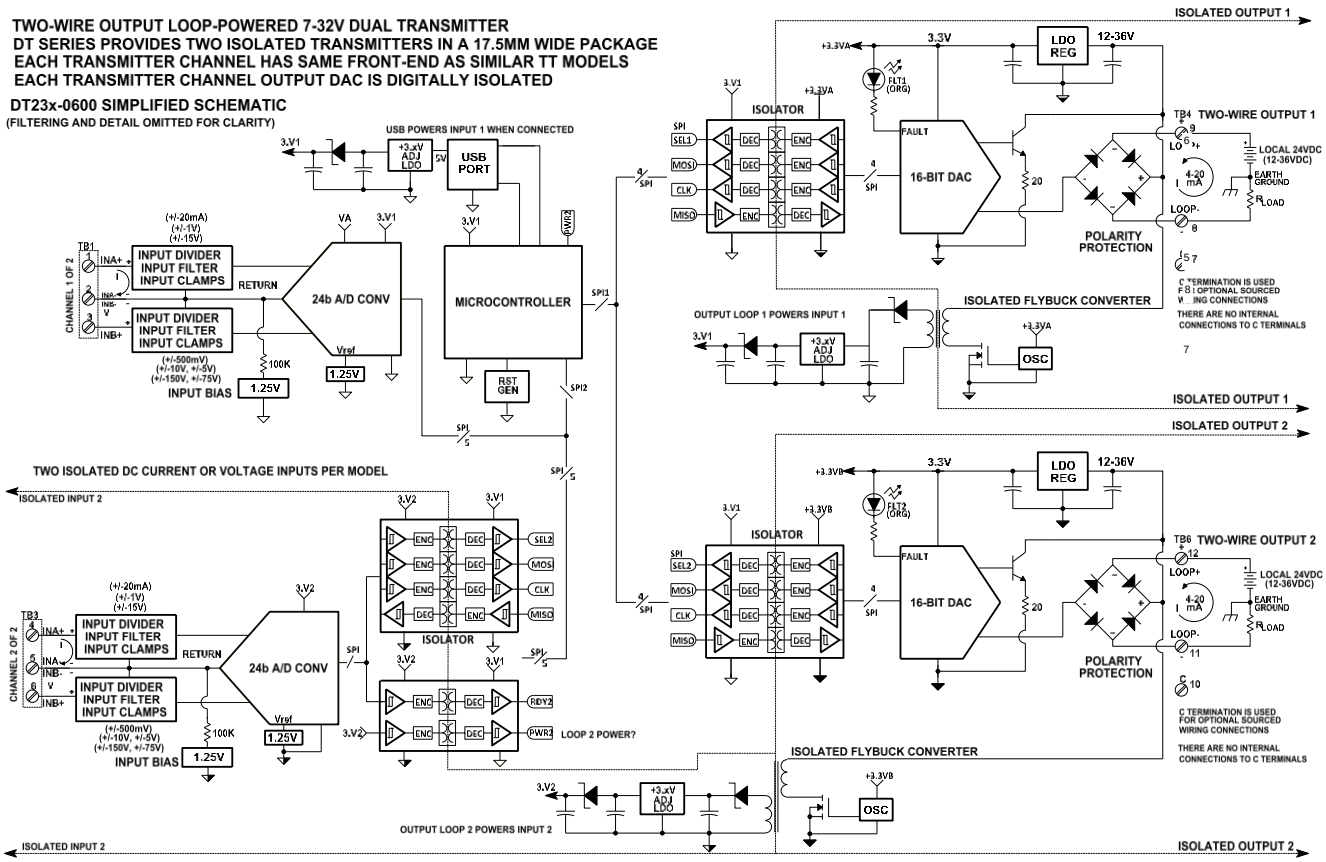
At this point, following Configuration or Calibration, you could choose the "Diagnostics" tab to display the Diagnostics page shown at left. From this page, you can test the transmitter's operation by polling the input channels.

Click **[Start Polling]** to trigger the software to periodically read the input channels and display their values in the fields below the polling button. Note the simulated lamp next to the polling button flashes slowly each time it samples the inputs. Click **[Stop Polling]** to stop polling the inputs before moving onto another tab/page.

See the second screen at left which is after starting polling. Note the input values are indicated in range units (mA for channel input A of DT236 models) and "No error" is displayed in the Communication status field.

Note that this page polls the input ADC readings of the unit's input channels, which does not include output DAC error.

BLOCK DIAGRAM



How It Works

Key Points of Operation

- Loop Powered
- Inputs/Outputs individually isolated.
- Output loop is Not Polarized.
- Input circuit common is connected to USB ground.
- USB powers a portion of the input circuit when connected, but not the output. This allows demo reconfiguration without powering output loop 1.
- DT236 voltage input is separate from the current Input. DT237 & DT238 models have two separate voltage inputs of different ranges.

This transmitter uses a microcontroller and two high-resolution A/D's to convert the input signals to a digital SPI signal isolated via digital isolators and transmitted to isolated current DAC's in each output. Power for the common isolated input 1 side of the circuit is provided via an isolated fly-back converter operating in parallel with output loop 1. Setup involves selecting the operating mode, input types/ranges (Current or Voltage), filter levels, and scaling input/output range endpoints. Output scaling can be optionally done in reverse to produce a reverse acting output. The possible linear operating range may be set between 3.5mA minimum and 24mA maximum. Refer to the block diagram to gain a better understanding of how this transmitter works. Note the input 1/USB, input 2, and each output/power circuit are isolated from each other. The USB port ground is connected to the input 1 circuit ground. Since the USB port ground of most PC's also connects to the USB cable shield and earth ground, and input sensors to this device may be grounded or ungrounded, it is recommended that USB signals from a PC be isolated to prevent a ground loop from occurring between the PC earth ground and an earth-grounded input sensor, which would have the negative effect of pulling the input 1 bias supply to ground, clipping the negative portion of the bipolar input 1 range.

TROUBLESHOOTING

Diagnostics Table

*Before attempting repair or replacement, be sure that all installation and configuration procedures have been followed and that the unit is wired properly. Verify that power is applied to the loop and that your loop power supply voltages are sufficient to supply over-scale current into the loads (up to 0.024*RI_{oad}), plus 7V MIN at the unit terminals, plus any line drop.*

If your problem still exists after checking your wiring and reviewing this information, or if other evidence points to another problem with the unit, an effective and convenient fault diagnosis method is to exchange the questionable unit with a known good unit.

Acromag's Application Engineers can provide further technical assistance if required. Repair services are also available from Acromag.

POSSIBLE CAUSE	POSSIBLE FIX
Software Does Not Detect Unit or the Communication Set up Screen is Blank…	
USB is not connected between unit and host PC.	Re-plug cable to verify USB cable from USB isolator is plugged into the unit and the isolator. Verify that USB cable from PC is also plugged into the PC USB port and into the isolator.
USB has not enumerated the device.	Use the reset button on the Acromag USB isolator to trigger renumeration of the transmitter, or simply unplug and re-plug the USB cable to the transmitter.
Communication or power was interrupted with USB connected and config software running.	Close the current connection with the software, then select and re-open the transmitter for communication (or simply exit the Configuration software and reboot it).
Cannot Communicate with Transmitter via USB…	
Unit fails to operate or exhibits an output shift…	
Output shifts off-range when you connect USB…	
A missing USB Isolator could cause a ground loop between a grounded input 1 signal/sensor and earth ground at a connected Personal Computer via its USB port.	Isolated transmitters can be used with grounded or ungrounded inputs and may only connect to grounded input sensors if the USB signals from the PC are also isolated. Without USB isolation, a ground loop is created between a grounded input and earth ground of the PC USB port. This module's input is biased 1.25V off input ground to allow it to process negative-going signals. Earth ground applied via the non-isolated USB connection with an earth grounded input 1 sensor would clip the input 1 bias and truncate its negative signal range. It's best to connect to USB via a USB isolator to protects from this and to increase safety and noise immunity. Use an isolator like the Acromag USB-ISOLATOR. Otherwise, use a battery powered laptop to configure the transmitter which does not normally earth ground its USB port.
Output is Erratic, Not operational, or at Wrong Value…	
Is your output loop power supply at the correct level for your load? Is Output Fault LED blinking?	Verify loop voltage and level in each output. Ideally, your supplies must be adequate to provide 7V MIN to the transmitter, plus the IR drop in the loop load, plus the IR drop in the lead wires, and all at the maximum loop current (>20mA).

Diagnostics Table…

POSSIBLE CAUSE	POSSIBLE FIX
Cannot Calibrate Input Channel…	
Are inputs wired properly?	Check that input is wired to correct ± input terminals using the correct polarity for your model. Note these models have two input paths A or B that differ by their supported nominal range.
Are you wired to the correct input terminals for your desired range?	TB1 and TB3 support multiple input ranges (refer to specifications).
Cannot Calibrate the Output or Cannot Test the Unit…	
Loop power ON in the units output circuit?	The unit receives power from both USB (when connected), and the output loop power supplies. While you can configure a unit over USB without loop power applied, a loop 1 power connection is required to test operation or calibrate the unit.
Unit drives a low current, but fails to drive higher output current...	
Loop supply voltage is too low to support current into the loop load or the loop load resistance is too large for the current level. Does the output fault LED blink at the higher current?	Check power voltage level. Make sure it is at least 7V plus 0.02x*Rload. If transmit distance is especially long, then it must have added voltage to support the IR drop in the wire. Ideally, the voltage should also have ample overhead to drive the load at the maximum upscale output current > 20mA.
Cannot Measure Input Voltage or Input Current…	
Your input may be wired to the wrong terminal. These models have two isolated input channels, each with two input paths A or B that differ by their supported nominal range.	For example, on the DT236, DC Current is input to path A TB1/TB3-1 (leftmost terminal), while ±0.5V DC is input to TB1/TB3-3 path B (rightmost terminal). For the DT237, only DC voltages up to ±1V connect to path A TB1/TB3-1. If you mistakenly wire these lower voltage signals to path B at TB1/TB3-3, your resolution will be poor as TB1/TB3-3 has a 12.52:1 divider at its input to support a larger signal span. Likewise, if you connect ±10V or ±5V to the DT237 path A at TB1/TB3-1/, you would drive it into over/under-range.
For input step, output appears to make 2 steps to reach its final value…	
For a step change at an input channel, the channel A/D typically needs two input samples to ramp up to its final level.	When you step the input signal, it takes two samples for the A/D to ramp up to its final value, and this is evident when using a scope to examine the output transition in response to a step change at the input, which appears to make two steps to arrive at its final level.

Diagnostics Table…

Output goes above Over-Range (20.7mA), or below Under-Range Limit (3.7mA)...	
If you have selected Namur compliant output limits, the input signal has gone outside of its linear operating range from 3.7mA to 20.7mA, indicating a fault condition of an open sensor or broken sensor lead. It might also occur due to contention between earth ground at a non-isolated PC USB port and input 1 sensor, or it may indicate failed communication with the output DAC (a firmware problem).	Check the input signal with respect to its range and reduce or increase it as required to drive the output current within its linear operating range. A fully upscale or down-scale signal can be driven by a sensor fault, such as an open or broken sensor lead, a ground fault with the input 1 sensor, or a DAC communication error. Check the wiring of your input sensor. If you are not isolating USB, check for a ground loop between a grounded sensor and earth ground of the PC USB port.
Output holds last value when I connect USB…	
Unit is awaiting initialization via its configuration software used to set it up, configure it, and calibrate it.	Boot the configuration software to regain operation. The USB port is intended for set up and configuration of the module and a unit should not be left connected to USB without also executing its USB software.
Output Fault (FLT) LED blinks...	
The corresponding output loop voltage is too low to support the loop load current, or the load resistance is too high for the loop supply voltage level. Note this LED will blink one time if loop power is turned off.	Check the corresponding output loop voltage level and wiring. Verify your output load resistance is less than R=(Vs-7)/0.02x. Note that an isolated 2-wire output is earth grounded at the Vs supply minus lead (load minus), not the transmitter output.

Service & Repair Assistance

This unit contains solid-state components and requires no maintenance, except for periodic cleaning and transmitter configuration parameter (zero and full-scale) verification. The enclosure is not meant to be opened for access and can be damaged easily if snapped apart. Thus, it is highly recommended that a non-functioning transmitter be returned to Acromag for repair or replacement. Acromag has automated test equipment that thoroughly checks and calibrates the performance of each transmitter and can restore firmware. Please refer to the Acromag Service Policy and Warranty Bulletin, or you may contact Acromag for complete details on how to obtain repair or replacement.

ACCESSORIES

Software Interface Package

Software Interface Package/Configuration Kit – Order TTC-SIP

- USB Signal Isolator
- USB A-B Cable 4001-112
- USB A-mini B Cable 4001-113
- Configuration Software CDROM 5040-944

This kit contains all the essential elements for configuring TT/DT/SP family Transmitters/Splitters. Isolation is recommended for USB port connections to these devices and will block a potential ground loop between your PC, a grounded input, or a grounded current loop. A software CDROM is included that contains the Windows software used to program the transmitter.

USB Isolator

USB Isolator – Order USB-ISOLATOR

- USB Signal Isolator
- USB A-B Cable 4001-112
- Instructions 8500-900

This kit contains a USB isolator and a 1M USB A-B cable for connection to a PC. This isolator and cable are also included in TTC-SIP (see above).

USB A-B Cable

USB A-B Cable – Order 4001-112

USB A-B Cable 4001-112

This is a 1 meter, USB A-B replacement cable for connection between your PC and the USB isolator. It is normally included with the TTC-SIP Software Interface Package and with the isolator model USB-ISOLATOR.

USB A-mini B Cable

USB A-mini B Cable – Order 4001-113

- USB A-mini B Cable 4001-113

This is a 1 meter, USB A-miniB replacement cable for connection between the USB isolator and the TT/SP transmitter/splitter. It is normally included in TTC-SIP.

Note that software for all TT/SP/DT Series models is available free of charge, online at www.acromag.com.

ACCESSORIES

USB OTG Cable

USB OTG Cable – Order 5028-565

- USB OTG Cable 5028-565

This is a 6-inch, USB On-The-Go cable for connection between the USB A-mini B Cable and an Android mobile phone or tablet that support USB. It is required to use the Acromag Agility™ Config Tool App for Android OS reconfiguration of this transmitter.

Note that the Acromag Agility ™ Config Tool/software APP is available free of charge, online at the Google Play store.

End Stops

Two End Stops – Order 4001-252

- Two 1027-222 End Stops for 35 mm DIN Rail mounting

For hazardous location installations (Class I, Division 2 or ATEX/IECEx Zone 2), you can use two end stops (Acromag 1027-222) to help secure modules to 35mm DIN rail (not shown).

SPECIFICATIONS

Model Numbers

DT236-0600, Dual DC I/V Input
DT237-0600, Dual Med DC V Input
DT238-0600, Dual High DC V Input

Dual Isolated Signal Transmitters
Isolated DC Current/Voltage Inputs
Two-Wire Loop-Powered Outputs
CE Approved
Includes cULus Class I, Div 2, ATEX/IECEx approvals

Custom calibration to your specifications can be added as a separate line item at time of purchase.

The DT model prefix denotes Dual Transmitter. The 3rd digit 2 denotes a 2-wire loop powered transmitter in the Acromag DT200 Transmitter family. The trailing two "3x" digits denote different combinations of current/voltage input types (36 denotes a dual combination DC current and low voltage input type, while the 37 denotes a dual medium DC voltage input type, and 38 denotes a dual high-level DC voltage input type). The "-0600" model suffix specifies a loop-powered unit with CE and cULus Class I, Division 2, ATEX/IECEx Zone 2 Approvals. Models can be mounted on standard 35mm "T" Type DIN rail.

Optional factory calibration to your own specifications is ordered as a separate line item at time of purchase, and on a per unit basis. This requires the specification of model, operating mode, input type/range, input filter (none, low, medium, or high), and scaled input range zero/full-scale values. You can also specify a normal 4-20mA or reverse 20-4mA acting output.

A standard model without added custom factory calibration is calibrated by default for dual 4-20mA DC at TB1/TB3-1 (DT236), ±1V DC at TB1/TB3-1 (DT237), and ±15V DC at TB1/TB3-1 (DT238), with both input channels mapped to a 4.000mA zero and 20.000mA full-scale output. Field reconfiguration/recalibration of any model will require use of the TTC-SIP configuration kit, ordered separately (see Accessories section).

Input

Models have two channels of two separate inputs for current and/or voltage depending on the model.

Unit has separate input channels at TB1 and TB3 and each channel has two signal paths that support different ranges. On DT236, DC current is input at TB1/TB3-1, and DC voltage at TB1/TB3-3. On DT237, ±1V DC is input at TB1/TB3-1, and ±10V at TB1/TB3-3. On the DT238, ±15V DC is input at TB1/TB3-1, and ±150V is input at TB1/TB3-3. Signal return for the channel is TB1/TB3-2.

Input Reference Test Conditions: DT236 TB1/TB3 input A is 4 to 20mA or input B is ±0.5V, DT237 TB1/TB3 input A is ±1V or input B is ±5V, DT238 TB1/TB3 input A is ±15V or input B is ±150V; Ambient Temperature is 25°C; Loop Power is set to 24V DC in each loop; and Outputs are 4-20mA and drive 250Ω Loads.
Input Range: Each channel has two input paths A & B at TB1 (channel 1) and TB3 (channel 2), each path supporting a different nominal input range. The input A/D processes input signals differentially. Input sub-ranges have their calibration auto-extrapolated from the calibration of the nominal native range for the input and may be subsequently calibrated for greater accuracy. A nominal input range may be rescaled smaller to drive the outputs.

MODEL	Input A at TB1-1/TB3-1	Input B at TB1-3/TB3-3
DT236	±1mA DC, ±20mA plus sub-ranges, 0-20mA, 4-20mA, 0 to 11.17mA. Uses a precision 24.9Ω current shunt to convert current to Vin.[1]	±0.5V plus sub-range 0-500mV. No resistive divider is present at TB1/TB3-3 and the input impedance is 15MΩ minimum.
DT237	±1V plus sub-range 0-1V w/ no resistive input divider.	±10V & ±5V, 0-10V, 0-5V DC w/ 86.6K/1084.6K divider.
DT238	±15V plus sub-range, 0-15V DC w/ 28K/527K divider.	±150V & ±75V, 0-150V, 0-75V DC w/5.36K/1003.36K divider [2]

[1]**Note:** An optional external sensor is required to monitor AC current signals for driving TB1/TB3-1 input A of the DT236 (see Acromag Model 5020-350). This toroidal sensor generates 0 to 11.17mA DC to drive the DC current input of this model with AC input current passing through its primary (see Table 2 of page 33 for scaling the AC current by number of primary turns).
[2]**Note:** Per cULus Shock & Fire Safety: +/- 150 VDC Maximum Battery Sources or +/- 60 VDC Maximum SELV MAINS Sources.

Input…continued

Analog to Digital Converter (A/D): Each input channel uses a 24-bit, Σ-Δ A/D converter with only the first 16-bits used. Its signal is normalized to a bipolar range count of ±25000 to simplify I/O scaling (see Input Resolution below).
Sampling Rate (A/D): Input ADC samples at a variable rate with filter as follows:

A/D SAMPLING RATE (SAMPLES/SECOND) PER INPUT FILTER			
NONE	**LOW**	**MED**	**HIGH**
214.65sps	53.6625sps	13.42sps	1.6775sps

Input Impedance: Each channel has two input circuit paths A & B that support different ranges. Input impedance will vary with the input path divider as follows:

	INPUT IMPEDANCE PER MODEL INPUT PATH DIVIDER	
MODEL	**INPUT A**	**INPUT B**
DT236-0700	24.9Ω Current Shunt	No Divider[1], 15MΩ
DT237-0700	No Divider[1], 15MΩ	86.6K/(998K+86.6K), 1MΩ
DT238-0700	28K/(499K+28K), 500KΩ	5.36K/(998K+5.36K), 1MΩ

[1]**Note:** Direct connection to A/D channel without a resistive divider.
Input Overvoltage Protection: Inputs include Bipolar Transient Voltage Suppressers and diode clamping along with series resistance and capacitive filtering.
Input Filter: RC filtering plus digital filtering, optimized and fixed per input range and filter selection within the Σ-Δ ADC. See also Normal Mode Noise Rejection and Output Response Time.
Noise Rejection (Common Mode): Varies by model with filter selection between no filtering and high filtering as follows (measured with a 100Ω input unbalance):

Typical Common Mode Noise Rejection		
MODEL	**NO FILTER**	**HIGH FILTER**
DT236	93dB	139dB
DT237	71dB	119dB
DT238	70dB	113dB

Noise Rejection (Normal Mode): Varies with input filter level and input path divider. The minimum measured rejection of the DT236 model is given which does not divide its inputs. The higher rejection of the DT237 & DT238 is estimated by adding 20*log[input_divider] (see Input Resolution for applicable dividers per input path).

Typical 60Hz Rejection for Input Path A & B per Input Filter Setting				
MODEL	**None (dB)**	**Low (dB)**	**Med[1] (dB)**	**High[1] (dB)**
DT236	A, B: 6	A, B: 25	*> 80dB[1]*	*> 80dB[1]*
DT237 est	A: 7, B: 28	A: 25, B: 47	*> 80dB[1]*	*> 80dB[1]*
DT238 est	A: 32, B: 51	A: 50, B: 70	*> 80dB[1]*	*> 80dB[1]*

[1]**Note:** At medium and high filter settings, the heavily attenuated 60Hz signal cannot be measured due to 4th order filtering by the input ADC which adds 80dB minimum of rejection at frequencies between 47Hz and 61Hz.
Bandwidth: The frequency where the DT236 is attenuated 3dB for each input filter level setting is shown below (DT237 & DT238 similar). See also Normal Mode Noise Rejection and Output Response Time.

Bandwidth (-3dB) per Input Filter Setting				
MODEL	**None (dB)**	**Low (dB)**	**Med (dB)**	**High (dB)**
DT236	16Hz	7Hz	1Hz	100mHz

Input…continued

Input Calibration: From the factory, all sub-ranges of major input range at an input terminal path are automatically calibrated via extrapolation from the calibration of that paths major range to save time (see Table 1 and note the ranges that share the same divider and gain—one exception is ±1mA of the DT236 where the gain doubles requiring a separate calibration for ±1mA). However, you may calibrate specific sub-range settings independently to increase their precision if desired. "

IMPORTANT: To prevent subsequent re-calibration of a range from stepping on the calibration of a sub-range, calibrate the smaller input range after its major range

Input Resolution: Input analog to digital conversion divides the input signal range into parts calculated by subtracting endpoint A/D counts computed via the expression (Vin*Gain/1.25) * 32768+32768. Vin is the voltage after the input divider and gain is applied to the signal (see Table 1). The input divider is different for input paths A & B. Ranges that share the same gain are calibrated by linearly extrapolating from their nominal input range calibration. For simplification, raw A/D counts indicated in Table 1 are normalized to ±25000/15.5 bits for ±100% (bipolar ranges), or 0-25000/14.5 bits for 0-100% (unipolar ranges), and the effective input resolution of a range will be the lesser of the raw resolution indicated in Table 1 or its normalized resolution. The effective I/O resolution will be the lowest of the A/D, its normalized value, or the output DAC (Output DAC resolution is 1 part in 43690 for 4-20mA output).

Table 1: DT INPUT RESOLUTION PER INPUT PATH/RANGE PER MODEL

DTx36 INPUT RANGE	xDIVIDER	xGAIN	A/D INPUT RESOLUTION[1]
A (TB1/TB3-1): ±20mA	24.9Ω Shunt	2	6658 - 58878 (1/52220)
A (TB1/TB3-1): 0-20mA	24.9Ω Shunt	2	32768 - 58878 (1/26110)
A (TB1/TB3-1): 4-20mA	24.9Ω Shunt	2	37990 - 58878 (1/20888)
A (TB1/TB3-1): 0-11.17mA	24.9Ω Shunt	2	32768 - 47350 (1/14582)
A (TB1/TB3-1): ±1mA	24.9Ω Shunt	32	11880 - 53656 (1/41776)
B (TB1/TB3-3): ±0.5VDC	NONE	2	6554 - 58982 (1/52428)
B (TB1/TB3-3): 0-0.5V DC	NONE	2	32768 - 58982 (1/26214)
DTx37 INPUT RANGE	**xDIVIDER**	**xGAIN**	**A/D INPUT RESOLUTION[1]**
A (TB1/TB3-1): ±1V DC	NONE	1	6554 - 58982 (1/52428)
A (TB1/TB3-1): 0-1V DC	NONE	1	32768 - 58982 (1/26214)
B (TB1/TB3-3): ±10V DC	86.6K/1084.6K	1	11837 - 53699 (1/41862)
B (TB1/TB3-3): ±5V DC	86.6K/1084.6K	1	22303 - 43233 (1/20931)
B (TB1/TB3-3): 0-10V DC	86.6K/1084.6K	1	32768 - 53699 (1/20931)
B (TB1/TB3-3): 0-5V DC	86.6K/1084.6K	1	32768 - 43233 (1/10465)
DTx38 INPUT RANGE	**xDIVIDER**	**xGAIN**	**A/D INPUT RESOLUTION[1]**
A (TB1/TB3-1): ±15V DC	28K/527K	1	11876 - 53660 (1/41784)
A (TB1/TB3-1): 0-15V DC	28K/527K	1	32768 - 53660 (1/20892)
B (TB1/TB3-3): ±150V DC	5.36K/1003.36	1	11762 - 53774 (1/42012)
B (TB1/TB3-3): ±75V DC	5.36K/1003.36	1	22265 - 43271 (1/21006)
B (TB1/TB3-3): 0-150V DC	5.36K/1003.36	1	32768 - 53774 (1/21006)
B (TB1/TB3-3): 0-75V DC	5.36K/1003.36	1	32768 - 43271 (1/10503)

[1]**Note:** AD_count = (Vin*Gain/1.25) * 32768+32768.

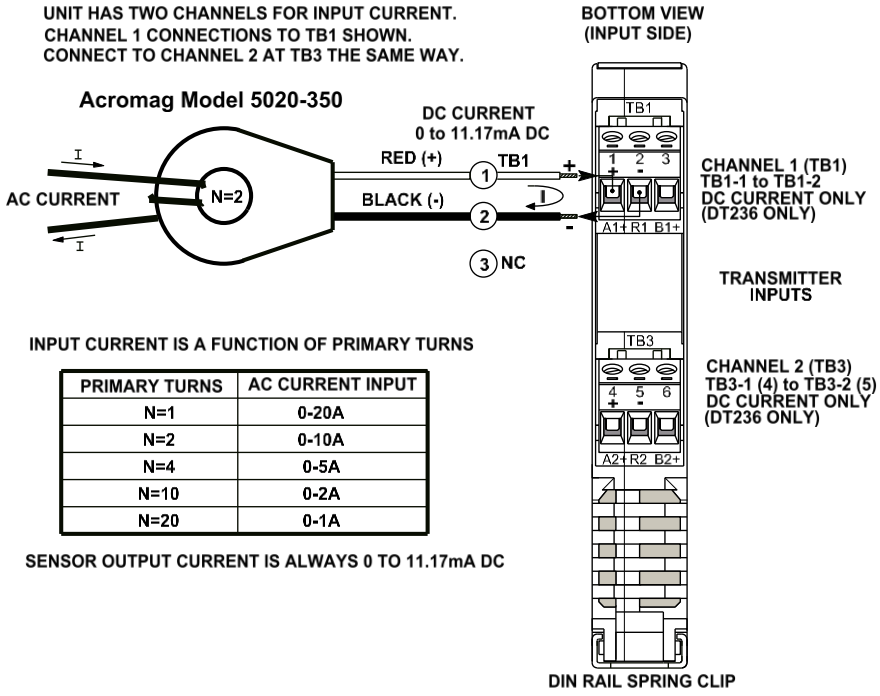
Input ranges may be rescaled to smaller ranges to drive their 4-20mA output. The effective input resolution is proportionally diminished as you rescale input span below nominal losing 1-bit every time you halve the range. So be careful not to diminish resolution below 12-bits minimum (1 part in 4096) for rated performance.

Input…continued

Optional AC Current Sensor (Model 5020-350, For AC Input to TB1 of DT236 only): Optional sensor can be connected to TB1 of the DT236 model for AC current sensing and is a toroidal instrument transformer that converts the sinusoidal 50-60Hz AC current signal into low level 0 to 11.17mA DC. The input AC current range is a function of the number of turns placed through the toroid as shown in Table 2 below. This sensor is isolated and requires no calibration or adjustment. When used with a D2336 module, it also facilitates AC current input isolation from the ADC voltage input, as well as redundant input isolation with respect to each output of this transmitter. When used with the DT236 module, it also facilitates AC current input isolation from the DC input, and redundant current input isolation with respect to the output of this transmitter.

The output wires of this current sensor are polarized with red as (+) plus and black as (-) minus. Normally these output wires are attached to one end of a user supplied cable, while the other end connects to the DC current input at TB1.

MODEL DT236-0600 WIRING TO AC CURRENT SENSOR



INPUT CURRENT IS A FUNCTION OF PRIMARY TURNS

PRIMARY TURNS	AC CURRENT INPUT
N=1	0-20A
N=2	0-10A
N=4	0-5A
N=10	0-2A
N=20	0-1A

SENSOR OUTPUT CURRENT IS ALWAYS 0 TO 11.17mA DC

Table 2: Optional AC Current Sensor Turns & Range

AC Current Input	Primary Turns	Sensor Output (Red/Black Wires)
0 to 20A AC	1	0 to 11.17mA DC
0 to 10A AC	2	"
0 to 5A AC	4	"
0 to 2A AC	10	"
0 to 1A AC	20	"

AC Input Burden: A function of the wire gauge resistance used for primary turns (the current carrying wire being monitored).**AC Current Sensor to Transmitter Wiring Distance**: 400 feet maximum for 18 AWG. Other wire gages can be used if the total resistance of both wires is less than 5Ω.

AC Input Overload: The sensor will withstand overload conditions as follows:

- 20 times full scale for 0.01 seconds.
- 10 times full scale for 0.1 seconds.
- 5 times full scale for 1.0 second.

Output

This unit has three operating modes: dual transmitter, single channel 1 transmitter, and CH1 signal splitter. Channel 1 loop power must be present in any mode.

Output Range: 3.5-24mA DC possible, 4-20mA nominal. Selecting Namur NE 43 clamp limits will provide a linear under-range down to ~3.7mA, and over-range up to ~20.7mA. Alternatively, you may set your own limits in a 3.5mA to 24mA range. Output current is linear with respect to the DC input current or voltage applied at the input terminals of the model (DT236 models optionally support AC current input at input path A when wired for use with Acromag AC Current Sensor 5020-350).

Output Accuracy: Accuracy is typically better than ±0.05% of span (±0.1% Max) for nominal input ranges. Relative accuracy varies with calibrated input and output span, and scaling. Accuracy includes the combined effects of repeatability, terminal point conformity, and linearization, but does not include sensor error.

Output Ripple/Noise: Less than ±0.1% of output span.

Note – High Speed Acquisition: Additional filtering at the load is recommended for sensitive applications with high-speed acquisition rates. For excessive 60Hz supply ripple, a 1uF or larger capacitor is recommended at the load. High frequency noise may be reduced or eliminated by placing a 0.1uF or 0.01uF capacitor directly across the load (this can also raise RF immunity).

Output Ambient Temperature Effect: Net effect of zero and span drift over temperature is better than ±0.008% of span per °C (±80ppm/°C) over the full ambient temperature range for reference test conditions (see Input Specifications).

Output DAC Resolution: Each output includes a 16-bit current DAC (Texas Instruments DAC161S997RGH) with current set to 24mA*COUNT/65536 (see Table 3). Its 4-20mA output will yield an output resolution of 54613-10923, or 1 part in 43690. Linear range limits are programmable or set to Namur limits near ~3.7mA (low) & ~20.7mA (upper), allowing you to discern an upscale or downscale lead break condition from the linear operating range. The effective I/O resolution of this transmitter will be the lowest of either the input, normalization, or the output.

Table 3: Output DAC Current Level & Digital DAC Count

I-LOOP = 24mA*COUNT/65536	COUNT = 65536*I-LOOP/24mA
3.7mA	10103
4.0mA	**10923**
12mA	32768
20mA	**54613**
20.7mA	56525
23.9996mA	65535

Output Response Time: The typical time per input filter setting measured for the output to reach 98% of its transition with a step change in the input signal while driving output current to a 250Ω load in series with a 24V loop supply.

	RESPONSE TIME TO 98% OF TRANSITION (TYPICAL)		
FILTER	**DT236**	**DT237**	**DT238**
NONE	31ms	136ms	39ms
LOW	51ms	147ms	62ms
MEDIUM	152ms	317ms	195ms
HIGH	1100ms	1109ms	1109ms

Output…continued

CAUTION: *Do not exceed 36VDC peak to avoid damage to the unit. Terminal voltage at/above 7V minimum must be maintained across the output during operation.*

Output Power Supply: Loop powered from 7-32V DC SELV (Safety Extra Low Voltage), 24mA maximum. The voltage across the output must never exceed 36V, even with a shorted load. Set this level to provide a minimum of 21mA over-range current to the load (0.021*R typical), plus 7V across the output terminals, plus any interim line drop. Reverse polarity protection is inherent as output terminals are not polarized (± output labels of enclosure are for reference only).
Output Power Supply Effect: Less than ±0.001% of output span effect per volt DC of supply change within rated limits for load.
Output Load Resistance Effect: Less than ±0.001% of output span effect for a ±100Ω change in load resistance.
Output Compliance and Load Resistance Equation: 7V minimum is required for each transmitter channel. A channel will drive up to 17V to a load with a 24V loop supply and 20mA of loop current (800Ω), assuming negligible line drop.

Compute R_{load} (Max) = (V_{supply} - 7V)/0.021A for 21mA output current. Refer to the table at right.

V_{supply} Volts	Max R_{load} w/21mA and No IR Line Drop
7V	0Ω
10V	143Ω
12V	238Ω
18V	524Ω
24V	810Ω
32V	1190Ω

USB Interface

Unit includes a USB socket for temporary connection to a PC or laptop for set up and reconfiguration (or optionally to a USB-OTG cable connected to an Android smartphone or tablet). USB isolation is required when connected to a grounded input sensor or driver (see note below). During reconfiguration and calibration, the transmitter receives power from both the USB port and the output loop. Both power sources must be present to calibrate the unit.

CAUTION: Do not attempt to connect USB in a hazardous environment. Transmitter should be set up and configured in a safe environment only.

Data Rate: USB v1.1 full-speed only, at 12Mbps. Up to 32K commands per second. USB 2.0 compatible.
Transient Protection: Adds transient voltage protection on USB power & data lines.
Inrush Current Limiting: Includes series inrush current limiting at USB power.
Cable Length/Connection Distance: 5.0meters maximum.

USB Interface…cont.

USB Connector: 5-pin, Mini USB B-type socket, HiRose UX60SC-MB-5S8(80).

PIN	DEFINITION
1	+5V Power (Includes Inrush Current Limiting)
2	Differential Data (+)
3	Differential Data (-)
4	NC – Not Connected
5[1]	Power Ground (Connects to Signal Ground via ferrite bead)
SHLD[1]	Signal Ground (Connects directly to Signal Ground)

[1]**Note:** Most Host Personal Computers (except battery powered laptops) will connect earth ground to the USB shield and signal ground.

IMPORTANT – USB Isolation is recommended: Input 1 of this transmitter is isolated from both outputs and from Input 2, allowing it to be connected to grounded or un-grounded input signals. However, the transmitter's input 1 circuit ground is connected in common to the USB power/signal/shield ground. This will in-turn make a connection to earth ground at the PC when directly connected to the USB port of a Personal Computer without using an isolator. Failure to connect USB without isolation would connect the 1.25V input 1 bias supply to input ground if the sensor is also earth grounded. This will interfere with operation and cause output 1 to shift. For this reason, USB isolation is strongly recommended when connecting to a PC. Otherwise, in the absence of USB isolation, and when connected to a grounded input 1 sensor, a battery powered laptop could be used to connect to the unit, as the laptop does not normally connect to earth ground.

Enclosure & Physical

General purpose plastic enclosure for mounting on 35mm "T-type" DIN rail.

Dimensions: Width = 17.5mm (0.69 inches), Length = 114.5mm (4.51 inches), Depth = 99.0mm (3.90 inches). Refer to Mechanical Dimensions drawing.

I/O Connectors: Removable plug-in type terminal blocks rated for 12A/250V; AWG #26-12, stranded or solid copper wire.

Program Connector: USB Mini B-type, 5-pin. See USB Interface.

Case Material: Self-extinguishing polyamide, UL94 V-0 rated, color light gray. General purpose NEMA Type 1 enclosure.

Circuit Board: Military grade fire-retardant epoxy glass per IPC-4101/98.

DIN-Rail Mounting: Unit is normally mounted to 35mm, T-type DIN rails. Refer to the DIN Rail Mounting & Removal section for more details.

Shipping Weight: 0.5 pounds (0.22 Kg) packed.

LED Indicators

Red Output Fault LED Indicators (Each Output, FLT1 & FLT2) - Red FLT LED per output loop. Blinking red continuously indicates the corresponding output load resistance is too high to modulate loop current accurately, or the loop voltage level is too low to drive the loop resistance at the desired current level. OFF is normal, blinks for fault, or blinks once if the loop power is lost or the loop is opened.

Environmental

It is recommended this unit be mounted upright on a DIN rail, allowing free air to flow into the bottom vent, pass through the unit and out the top vent.

Operating Temperature: -40°C to +80°C (-40°F to +176°F).
Storage Temperature: -40°C to +85°C (-40°F to +185°F).
Relative Humidity: 5 to 95%, non-condensing.
Altitude: Up to 2000 meters.
Isolation: The Input 1/USB, Input 2, Output 1, and Output 2 circuits are isolated from each other for common-mode voltages up to 250VAC, or 354V DC off DC power ground, on a continuous basis (will withstand 1500VAC dielectric strength test for one minute without breakdown). Complies with test requirements of **UL 61010C-1 First Edition, August 9, 2002 "UL Standard for Safety for Process Control Equipment"** for the voltage rating specified.
Installation Category: Suitable for installation in a Pollution Degree 2 environment with an Installation Category (Over-voltage Category) II rating per IEC 1010-1 (1990).
Shock & Vibration Immunity: Random vibration: Designed to comply with VITA 47 Class V1. Shall withstand vibration from 5 to 100Hz. with Power Spectral Density (PSD) = $0.04g^2/Hz$, for 1 hour per axis. Testing shall be in accordance with MIL-STD-810, Method 514, Procedure 1. Mechanical shock: Designed to comply with VITA 47 Class OS1, 20g, 11ms half sine and terminal sawtooth shock pulses. 3 shock pulses in each direction along 3 axes (36 shocks, total). Testing shall be in accordance with MIL-STD-810, Method 516, Procedure 1.

Electromagnetic Compatibility (EMC)

Minimum Immunity per BS EN 61000-6-1:

1) Electrostatic Discharge Immunity (ESD), per IEC 61000-4-2.
2) Radiated Field Immunity (RFI), per IEC 61000-4-3.
3) Electrical Fast Transient Immunity (EFT), per IEC 61000-4-4.
4) Surge Immunity, per IEC 61000-4-5.
5) Conducted RF Immunity (CRFI), per IEC 61000-4-6.

This is a Class B Product with Emissions per BS EN 61000-6-3:

1) Enclosure Port, per CISPR 16.
2) Low Voltage AC Mains Port, per CISPR 14, 16.

Agency Approvals

Electromagnetic Compatibility (EMC): CE marked, per EMC Directive 2014/30/EU.
FCC Conformity: This device complies with Part 15, Class B of the FCC rules.
Safety Approvals: cULus Listed Class I, Division 2, Groups A, B, C, D Hazardous Location or Nonhazardous Locations only. These devices are open-type devices that are to be installed in an enclosure suitable for the environment. Consult Factory.
ATEX/IECEx Certified: ATEX/IECEx Certified for Explosive Atmospheres per ATEX Directive 2014/34/EU which complies with standards EN IEC 60079-0:2018, EN IEC 60079-7:2015 +A1:2018, IEC60079-0 Edition 7, and IEC 60079-7 Edition 5.1.

Ex II 3 G Ex ec IIC T4 Gc -40°C ≤ Ta ≤ +80°C
UL 20 ATEX 2416**X** IECEx UL 20.0088**X**
X = Special Conditions

1) The equipment shall only be used in an area of not more than pollution degree 2, as defined in EN/IEC 60664-1.
2) The equipment shall be installed in an enclosure that provides a degree of protection not less that IP 54 and only accessible with the use of a tool in accordance with EN/IEC 60079-0.
3) Transient protection should be provided and set to a level not exceeding 140% of the peak rated voltage value at the supply terminals to the equipment.

Reliability Prediction

MTBF (Mean Time Between Failure): MTBF in hours using MIL-HDBK-217F, FN2. *Per MIL-HDBK-217, Ground Benign, Controlled, G_BG_C*

Temperature	MTBF (Hours)	MTBF (Years)	Failure Rate (FIT[1])
25°C	1,177,353 hrs	134.4 years	849.4
40°C	783,595 hrs	89.5 years	1276.2

[1]Note: FIT is Failures in 10^9 hours.

Configuration Controls

Refer to Operation Step-By-Step in the Technical Reference section of this manual for detailed information on available software control of this model.

Software Configuration Only via USB/Windows or USB-OTG/Android & Agility: This transmitter drives separate isolated 2-wire loops proportional to sensor inputs based on differential voltage measurements across the sensors at TB1 (channel 1) and TB3 (channel 2), or on the differential voltage measure across its 24.9Ω current shunt resistor for current input path A at TB1 or TB3 (DT236 only). No switches or potentiometers are used to make adjustment to this transmitter. Its behavior as an isolated signal amplifier/transducer is determined via programmed variables set using a temporary USB connection to a host computer or laptop running a Windows-compatible configuration software program specific to the transmitter model, or a wired USB-OTG connection to an Android smartphone or tablet running Agility. The USB software or Agility app provides the framework for digital control of all configuration and calibration parameters, which are ultimately stored in non-volatile memory of the unit.
LED Indicators, Red FLT1 & FLT2: One Red FLT LED per output loop w/continuously blinking red indicating the output load resistance is too high to drive its current accurately, or the loop voltage level is too low to drive the loop resistance at the desired current level. OFF is normal and this LED will only blink one time if loop power is lost or the loop is opened.

REVISION HISTORY

The following table shows the revision history for this document:

Release Date	Version	EGR/DOC	Description of Revision
11-DEC-18	A	BC/MO	Initial Release Version
16 JUN 2020	B	BC/ARP	MTBF information and EMC Directive updated.
15 SEP 2020	C	CAP/APR	Added cULus, ATEX, IECEx, and FCC approvals
28 JAN 2022	D	CAP/AMM	Added Altitude: Up to 2000 meters (Environmental Section)