



October 14, 2009

ML0012

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No . MTWIN4B 2, 2½ Element (DELTA & WYE) Φ A Ref

No . MTWIN5B 2, 2½ Element (DELTA & WYE) Φ B Ref

No . MTWIN6B 2, 2½ Element (DELTA & WYE) Φ C Ref

Firmware Version 4.30 and Later

Includes Information on CI1 Option (1 Amp Inputs)

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FIRMWARE REVISIONS

PowerPlex Firmware	Description
4.00	Original PowerPlex RTS Transducer Firmware.
4.10	Eliminated potential error at unity power factor and high signal levels. Also corrected improper value in Device ID register.
4.20	Added Tag Register, Configuration Registers, Network Screen setup. Changed to FFT fundamental quantities for determination of PF and VARs sign (RTH Only).
4.30	Added RT (MTWIN_B) support.
4.50	Fixed energy BCD conversion bug.

CERTIFICATION

Bitronics LLC, certifies that the calibration of its products are based on measurements using equipment whose calibration is traceable to the United States National Institute of Standards Technology (NIST).

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1.0 DESCRIPTION

1.1 Introduction

The Bitronics Three Phase PowerPlex RTS Digital Transducer is an all digital re-invention of the traditional analog transducer concept. Unlike its analog predecessors, the PowerPlex RTS can communicate information about many quantities over just one output, vastly reducing the number of transducers and wire connections needed. These quantities include current and voltage, as well as real and reactive power, power factor, energy, and frequency; all essential quantities which must be measured accurately in order to optimize the control and delivery of electric power. Additionally, the PowerPlex RTS delivers real-time synchronizing measurements of phase difference, voltage and frequency across a tie-line or bus-tie breaker. These added measurements, coupled with the high speed response, allow users to create sync-check, auto sync-check and automatic synchronizers, utilizing only the PowerPlex RTS and a PLC. The use of "State-of the Art" microprocessor technology assures digital accuracy and repeatability across a wide range of input signal levels. The PowerPlex RTS Digital Transducer is a rugged electronic instrument designed for utility and industrial applications requiring high-speed, reliable, precise measurements of three-phase power systems. True RMS measurements are standard, and accuracy is maintained even with the presence of harmonics above the 31st harmonic on current and voltage waveforms. The standard power supply for the PowerPlex RTS allows it to be used on a variety of common AC or DC voltages, and the PowerPlex RTS also provides the user with the capability to connect directly to the high-speed Modbus Plus network. This capability allows users to seamlessly integrate the RTS instruments into an existing or planned SCADA or PLC system.

1.2 Features

- * High Speed
- * Synchronizing Measurements
- * All measured quantities available over the digital communications channel to SCADA or PLC systems.
- * Non-volatile memory backup of CT/PT settings. No batteries are needed.
- * On board diagnostics continually monitor instrument performance. Diagnostic codes available over network.
- * Separate Modbus Plus communications microprocessor to off-load the main processor.
- * Universal power supply works on AC or DC service; 24, 48, 125 or 250V dc station batteries or 115V ac service. AC-only power supplies allow +/- 20% line voltage variation. Available for 115 or 230V ac systems.

- * UL listed (UL-3111-1), CSA listed (CSA C22.2 1010.1-92) and IEC 1010-1
- * True RMS measurements are standard.
- * Rugged metal housing fits into existing analog transducer installations.
- * Watchdog timer maximizes system reliability.
- * Front panel switch selects 2 (DELTA) or 2½ (WYE) Modes.

1.3 Specifications

Input Signals:

Amperes: 0 to 5*A ac (0.25*A ac minimum for PF), with continuous overload to 10*A ac (15*A ac for Neutral Current), 400A ac for 2 seconds. 2500V ac isolation, minimum.

Volts: Range 0 to 150V ac, 120V ac nom., three phase. 2500V ac min isolation. Minimum input for PF, Frequency or Phase Angle = 20Vac.

Signal Burden:

Amperes: 4 mVac at 5Aac input (0.02 VA).

Volts: <1 mAac at 120Vac input (0.1 VA).

Accuracy:

0.25% Class (ANSI Std 460-1988).
 Vref 0.5% @FREF = FLINE +/- 1Hz
 Frequency: +/- 0.01 Hertz
 Phase: +/- 0.3°

Signal Frequency:

45Hz to 1860Hz (Including Harmonics).
 45.00Hz to 75.00Hz Frequency Measurement

Energy Registers:

0 - 99,999,999 kWattHours Positive and Negative
 0 - 99,999,999 kVARHours Leading and Lagging
 Energy is calculated continuously, and stored every 90 seconds

Communications protocol: Modbus Plus

Data update rate:

New data available every 100msec Global Data only (56 to 75Hz)
 New data available every 100msec to 150msec with READ or WRITE Holding Registers (45 to 75 Hz)

1.3 Specifications, (Cont'd)

Power Requirements:

VD10: Universal 55-200 Vac or 20-280 Vdc, 6 Watts
VA5: 115 Vac +/- 20%, 6VA
VA3: 230 Vac +/- 20%, 6VA

Fuse: 1.5 Ampere, non-time delay (M) fuse, UL listed located in the ungrounded (hot) side of the line, external to meter.

Operating Temp: -30C to 70C.

Humidity: 0-95% non-condensing

Installation Category: IC III (Distribution Level), Pollution Degree: 2

Weight: 3.5 pounds (1.60 kilograms)

Size: 5.25"H x 5.60"W x 5.63"D

* - When CI1 Option (1Amp Input) is installed, divide this value by 5

2.0 PRINCIPLES OF OPERATION

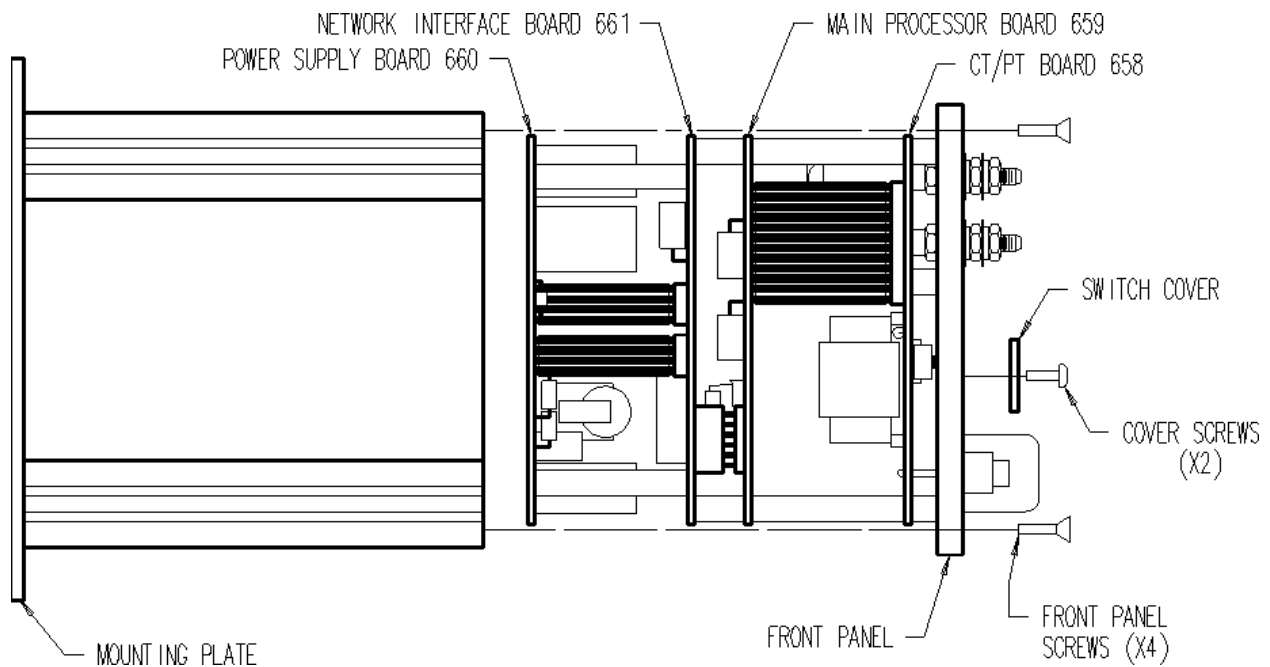


Figure 1 – Transducer Exploded View

2.1 Construction

The Bitronics PowerPlex Digital Transducer is composed of four Printed Circuit Board Assemblies, as shown in the exploded view of the meter (Figure 1). They are the back panel and Current Transformer & Potential Transformer Board, the Main Processor board, the Network Interface Board, the Power Supply Board. Additionally, a small section is separated from the Network Interface Board (containing the output connector, address switches, and indicator lights) at the time of manufacture and placed next to the CT/PT Board on the front panel. The CT/PT Board contains primarily passive components (transformers, connectors, etc.). Ninety percent of the active electronics (Integrated Circuits, diodes, etc.) are contained within the Main Processor and Network Interface boards. Detailed descriptions of each of the boards can be found in the following sections.

2.1.1 Output Connector Board

The digital communications channel interfaces to the remainder of the instrument via the output connector board. Also located on this board are Power and Status LED indicators, and address switches. Refer to the appropriate protocol option manual for the specific functions of this board.

2.1.2 Current and Potential Transformer Board (CT/PT Board)

The current and potential transformer (CT/PT) board contains secondary transformers which provide electrical isolation for each of the signal input channels, as well as the switch to select 2 (DELTA) or 2½ (WYE) Element operation. Current from the current terminals flows through a silver-soldered shunt of negligible resistance to assure that the user's external CT circuit can never open-circuit, even under extreme fault conditions. Potential voltages are carried through #8 screws on high barrier terminal strips directly to the CT/PT board to guarantee reliable connections to the high-impedance secondary transformer circuits. The use of transformers on all input leads provides excellent isolation between the inputs and any output. The PowerPlex Digital Transducer uses a six wire voltage input, which along with Element Select Switch allows great flexibility in connection.

Bitronics PowerPlex instruments provide for complete interchangeability of Main Processor and CT/PT boards. Compensation for normal variations in input circuits is achieved by storing calibration constants in a non-volatile memory (EEPROM) which resides on the CT/PT board. These constants are factory-programmed to provide identical signal gain (attenuation) in each of the six isolated signal input paths. The CT and PT settings for scaling the transmitted values to the user's CTs and PTs are also stored in this EEPROM. Checksums are incorporated into the EEPROM which are read periodically by the microcontroller to check the integrity of the calibration constants and the CT and PT setting (See section 4.1). The Energy Registers are also stored in this EEPROM (See section 2.2.4). Checksums are incorporated into the EEPROM which are read periodically by the microcontroller to check the integrity of the energy registers.

2.1.3 Power Supply Board (PS Board)

2.1.3a Universal Power Supply

The Universal power supply is a high-efficiency, high-frequency switching power supply with integrated over-current protection. Power from the input terminals is conducted to a full-wave bridge rectifier and capacitor to convert AC power inputs to DC. DC power inputs are unaffected by the bridge rectifier. Input polarities are marked for reference only. The DC voltage across the filter capacitor is alternately connected and is connected to the isolation/power transformer at a rate of about 60kHz, by a pulse-width controller. A separate feedback winding on the power transformer provides a signal which is used by the controller to vary the time that the transformer is connected to the power source. This allows the supply to provide a relatively constant output voltage over a wide range of input voltages and output loads. The output of the switching supply is then post regulated by low-drop linear regulators to provide precise supply voltage control under all conditions. Two separate, isolated outputs are created; one for the output port, and one for the rest of the instrument.

2.1.3b AC Power Supply

The AC power supply circuit is a conservative, conventional design. Low drop rectifiers and a low drop-out solid state regulator minimize internal power dissipation. Filter capacitors are operated at a fraction of their voltage and temperature ratings, and should provide years of trouble-free service under extreme environmental conditions. Two separate, isolated outputs are created; one for the output port, and one for the rest of the instrument.

2.1.4 Main Processor Board (MP Board)

The Main Processor Board is divided into two parts, the Analog and Digital processor sections:

2.1.4a Main Processor Analog Processing Section

The first function of Analog Processing section is to sum the three low level AC signals from the three CTs to form the Neutral Current Signal (2½ Element Mode only). A second analog summer is used to sum the phase A and C voltage signals to form the phase B input voltage for use in 2½ Element Mode. This same summer is used in 2 Element mode to sum the A-B voltage and the BC voltage to form the A-C voltage. These functions are all performed by precision analog summing circuits. The second function of Analog Processing section is to sample and digitize the low level AC signals provided by the CT/PT board, and to provide a digital number to the microcontroller section for further processing. Calibration constants stored in both the CT/PT EEPROM and the EEPROM located on this board provide drift-free calibration, and complete interchangeability of Main Processor boards. Checksums are incorporated into both EEPROMs which are read periodically by the microcontroller to check the integrity of the calibration constants and the CT and PT setting (See section 4.1). A "Master Gain" trimpot is also located on the MP board to provide the user with fine tuning capability if it is necessary to match other devices on the power system.

2.1.4b Main Processor Digital Microcontroller Section

The host microcontroller section consists of an Intel 87C251SB microcontroller (MCU), address latch, EPROM memory, SRAM memory and a watchdog timer. All the data acquisition and signal processing are controlled by the microcontroller. Communications to other boards is accomplished via a serial data link consisting of three lines common to all the other devices (ADC, 2 EEPROMs). Individual select lines for each individual device allow the MCU to communicate with one device at a time. The watchdog timer prevents the MCU from "locking up" in the event of a transient or other type of interference. The watchdog timer also provides a reset on power-up or when resuming from a brownout (low supply). In the unlikely event of a microcontroller failure, the watchdog circuit will continuously attempt to restart the processor.

A DUAL-PORT RAM is also located on the Host MCU board. The purpose of the DUAL-PORT RAM is to provide a communications channel between the Host MCU and the microprocessor on the Network Processor Board. The two processors pass "messages" through this RAM in order to service specified communications protocol transactions.

2.1.5 Network Interface Board

The Network Interface Board contains the intelligent interface between the host MCU board and the specified communications protocol. The board content varies with the specific protocol chosen and is fully described in the appropriate protocol option manual.

2.2 Measurement Principles

All the quantities measured by the PowerPlex instrument utilize digital signal processing (DSP). This technique allows the instrument to measure a large number of quantities with a small amount of hardware. It also allows field upgrades, since the signal processing algorithms are in an EPROM, and can be simply changed to provide new features. The following section will give a brief overview of the measurement principles.

2.2.1 Voltage / Current

Signal processing begins with the low level AC signal supplied from the CT/PT board which is about 1 Vac RMS for a full scale input signal. Pure sine wave inputs or complex, distorted, periodic waveforms are handled equally well - a major advantage when computing WATTS and VARs as well as true RMS currents and voltages. This design frees the user from concern about errors which will otherwise occur during the measurement of distorted waveforms with non-true RMS instruments. Voltage of a given phase is sampled first, followed by the current of the same phase. Phases A, B and C are sampled in succession, providing the MCU with instantaneous measurements of all voltage and current inputs. A separate set of samples is taken of the REFERENCE voltage input. Samples are accumulated for 3 cycles, at which time the MCU calculates the Volts and Amps for each LINE phase, and the Volts for the REFERENCE phase. Any Zero Offset or drift is compensated for every calculation cycle.

Since the PowerPlex RTS only has 3 PT input channels, one is used for the Reference input, and the other two are used for the Line inputs of the 3 phase system. With only two of the three voltage signals present, it is necessary to generate the third voltage signal internally.

In 2½ Element mode on MTWIN4B/6B, an artificial phase B voltage is created by a vector sum of the phase A and phase C voltages. A summing amplifier, located on the Main Processor Board, is used to create the phase B signal. This artificial phase B signal is used in all relevant calculations. In 2 Element mode, an artificial C-A voltage is created by the vector sum of the A-B and B-C voltages. This internally generated signal is only used in the Phase C-A Voltage calculation.

In 2½ Element mode on MTWIN5B, an artificial phase A voltage is created by a vector sum of the phase B and phase C voltages. A summing amplifier, located on the Main Processor Board, is used to create the phase A signal. This artificial phase A signal is used in all relevant calculations. In 2 Element mode, an artificial B-C voltage is created by the vector sum of the A-B and C-A voltages. This internally generated signal is only used in the Phase B-C Voltage calculation.

2.2.2 Neutral Current (Residual Current) for WYE Connections

In the WYE mode, the analog voltage signals from the three phase currents are summed on the Main Processor Board to form a new analog input that represents the Neutral Current (Residual Current). This signal is sampled at the same time as the other seven signals (Phase Currents and Voltages). Samples are accumulated for 3 cycles, at which time the RMS value of the Neutral Current (Residual Current) is calculated by the MCU.

2.2.3 Watts / VARs

Instantaneous Watt samples are accumulated for 3 cycles, at which time the MCU calculates the WATTS and VARs for each phase. The VARS quantity for each phase is derived from a power triangle calculation where the WATTS and VAs are known. This technique provides a "true" measure of VARs even with distorted waveforms. Zero offset is also adjusted for each signal channel every 100msec by the MCU. These per-phase quantities are then summed to form the total three phase WATTS and VARS.

2.2.4 Energy

The WATT and VAR values are calculated every 100msec. These values are then multiplied by a time factor in order to generate WATThours and VARhours. The signs of the WATThour and VARhour values are then checked, and the values are then added to the appropriate registers (Positive/Negative WATThours, Lead/lag VARhours). These registers are updated every 100msec. In order to retain the energy values during a power failure, the registers must be stored in the EEPROM on the CT/PT board of the unit. The EEPROM has a limited number of write cycles, so the energy registers are only written every 90 seconds. At this rate, the EEPROM will last in excess of 15 years at rated conditions. Checksums are incorporated into the EEPROM which are read periodically by the microcontroller to check the integrity of the energy registers. The registers are in **PRIMARY** kilowatt-hours and kiloVAR-hours, and the CT and PT ratio are used to calculate the primary units.

The Energy registers count to a maximum of 99,999,999 units before rolling over to zero. It is the responsibility of the user to ensure that these values are read often enough to detect every rollover. All the Energy registers can be RESET to 0000 through the communications interface. Refer to the appropriate protocol option manual for the protocol specific RESET command. The energy values will be reset within 0.6 seconds, however it takes the meter 4 seconds to clear the energy data stored in the EEPROM. The USER must ensure that the power is not interrupted to the meter for this 4 second period after the energy is RESET or the reset may NOT occur.

2.2.5 Frequency

The Frequency measurement is generated by timing zero-crossings of the input Line Voltages or Line Currents over a period of 100msec. The microprocessor uses Phase A voltage (A-B in Delta) if available, for the frequency measurement. If Phase A is not available, the processor will switch to Phase B (B-C) and then to Phase C (C-A). If none of the voltages are available, the processor will attempt to use the Phase A current, then the Phase B current, then the Phase C current. The zero-crossings are determined from the analog samples directly. The samples are first sent through a smoother, which acts as a lowpass filter. Knowing the number of zero-crossings and the time between them, the frequency can be calculated. The input voltage must be greater than 20Vac for the frequency function to determine a value. If the input voltage is too low, or the frequency is below 45Hz, the instrument will return a value of 0Hz. If the frequency is above 75Hz, the instrument will return a value of 99.99Hz.

A separate set of measurements and calculations are performed on the REFERENCE input.

2.2.6 Volt-Amperes

The per-phase VA measurement is calculated from the product of the per-phase Amp and Volts values. In WYE mode, the three-phase VA measurement is the sum of the per-phase VA values (Arithmetic VAs). In 2-element (DELTA) mode, the three-phase VA measurement is calculated from a power triangle $VA^2 = W^2 + VAR^2$ (Geometric VAs).

2.2.7 Power Factor

The per-phase Power Factor measurement is calculated using the "Power Triangle", or the perphase WATTS divided by the per-phase VAs. The three-phase PF is similar, but uses the three-phase WATTS and VAs instead. The Power Factor measurements require a minimum current of approximately 0.25A ac and minimum voltage of approximately 20Vac to determine an accurate answer. If the input signals are below these values, the instrument will indicate an under-range by setting the value in the register to an out-of-range value (refer to protocol manual for specific values).

2.2.8 Phase Angle

The PowerPlex RTS calculates phase angle between the Phase A-N LINE(MTWIN4B) (B-N for MTWIN5B, and C-N for MTWIN6B) voltage and the REFERENCE voltage input (WYE), or the Phase A-B LINE(MTWIN4B) (B-A for MTWIN5B and C-A for MTWIN6B) voltage and the REFERENCE voltage input (DELTA). The Line voltage input is sampled for 3 cycles, and the Reference input is sampled for 3 +/- cycles, depending whether the reference input is faster or slower than the Line input. Both inputs are put through a smoother and a lowpass filter to remove any harmonic and noise effects. Both sets of samples are then sent through a 16 point FFT, and the phase difference of the fundamental component of each input is determined. The phase angle that is calculated is the average of the 3 cycle sample, or put more simply, the phase angle difference at the center of the sample window. The register value is updated approximately 45msec + 1.5 cycles after the point at which

the sample was taken, therefore at 60Hz, the delay would be 70msec. The Phase Angle value is a signed (positive or negative) value between 0 and +/- 180 degrees. The convention for the sign of the phase angle is that positive indicates that the Line is leading (ahead) of the Reference input. A negative phase angle would indicate that the Line is lagging (behind) the Reference input. Phase angle calculations require that both the reference and line input be between 45Hz and 75Hz, and that both inputs be above 20Vac. If the inputs do not meet these limits, the phase angle is set to -180 degrees.

3.0 INSTALLATION



WARNING - INSTALLATION AND MAINTENANCE SHOULD ONLY BE PERFORMED BY PROPERLY TRAINED OR QUALIFIED PERSONNEL.

3.1 Initial Inspection

Bitronics' instruments are carefully checked and "burned in" at the factory before shipment. Damages can occur, however, so please check the instrument for shipping damage as it is unpacked. Notify Bitronics immediately if any damage has occurred, and save any damaged shipping containers.

3.2 Grounding

There are two chassis ground points that **MUST** be connected to Earth Ground. One is terminal #7 (next to the Power inputs), and the other is the transducer mounting flange. Bitronics recommends that all grounding be performed in accordance with ANSI/IEEE C57.13.3-1983. The Ground terminal #7 is connected to the Line (+) terminal #8 through a 0.01uF UL listed capacitor, not with an MOV, in order to preserve ground isolation when the unit is operated from DC station battery service.

3.3 Power and Input Signal Connections

3.3.1 Power Supply Connections

Power and chassis ground is applied to three #8 screws on a barrier strip on the front of the instrument. **Connection of the chassis ground is required; see Section 3.2.** Because of the solid state design, the total load required to operate the unit is less than six WATTS. An external transient suppression board is mounted on the three power terminals of the barrier strip. It provides an MOV from Line(+)-to-Neutral(-), and a capacitor from Line(+)-to-Ground. Note that the marking of "Neutral" on terminal #9 is for reference only. It is not required to connect the unit from Line-to-Neutral when the unit is powered from an AC source; it may be connected to any AC source, provided the input and isolation voltages are not exceeded.

3.3.1a Universal Power Supply (-VD10)

See Section 2.1.3a for complete description of the Universal supply operation. The Universal power supply can operate from any voltage between 20 to 280V dc, or 55 to 200Vac. It is therefore possible to power the PowerPlex Digital Transducer with AC or DC station power or an auxiliary PT, provided the voltage remains above 55 V ac or 20 V dc.

3.3.1b AC Power Supply (-VA3, -VA5)

See Section 2.1.3b for complete description of the AC supply operation. The nominal line voltages are listed in the Specifications, Section 1.3.

3.3.2 Current Input (CT) Connections

The impedance at the PowerPlex current (CT) terminals is nearly a short circuit (2 milliohms). These ideal impedances provide low burden loads for the CT circuits supplying the signals. The PowerPlex Digital Transducers have three independent current inputs, one for each phase being measured. Current signals are connected directly to #10-32 brass studs on the front panel of the instrument. **WARNING - DO NOT** overtighten the nuts on the input connections, **HAND** tighten with a standard nutdriver, 12 inch-pounds is recommended, **MAXIMUM** torque is 15 inch-pounds.

The instrument can be connected directly to current transformer (CT). Grounding of CT signals per ANSI/IEEE C57.13.3-1983 is required.

3.3.3 Voltage Input (PT) Connections

Voltage signals are connected to the #8 screws on the barrier terminal strip on the front of the unit. The impedance at the PowerPlex voltage (PT) terminals is high impedance (> 100 K-ohms). These ideal impedances provide low burden loads for the PT circuits supplying the signals. The polarity of the applied signals is important to the function of the instrument, and the signal terminals are labeled LO or HI to aid in wiring the units into substation or control panels. A wiring diagram is also provided in the form of a decal on the side of the unit. Grounding of PT & CT signals per ANSI/IEEE C57.13.3-1983 is recommended.

3.4 Overcurrent Protection

A UL recognized 1.5 Ampere non-time delay (M) fuse is to be series connected in the ungrounded (hot) side of mains input as part of installation of this product.

3.5 Mains Disconnect

Equipment shall be provided with a Mains Disconnect, that can be actuated by the operator and simultaneously open both sides of the mains input line. The Disconnect shall be UL Recognized and acceptable for the application.

3.6 Instrument Mounting

The instrument may be mounted on a standard transducer mounting hole pattern if desired. See Figures 2 and 3. The unit should be mounted with four #8-32 screws. Make sure that any paint or other coatings on the panel do not prevent electrical contact. The transducer is intended to be connected to earth ground at the mounting plate. See section 3.2.

3.7 Surge Protection

It is recommended that a metal oxide varistor (MOV) be placed across the power supply input to protect the meter in the event of high voltage surges or lightning strikes. PowerPlex Digital Transducers are shipped with a transient suppression network already attached as a standard design. An MOV provides an added measure of protection against heavy switching transients occasionally experienced in the field. The MOV is designed to clamp applied power voltages above 270V ac RMS. A single MOV protects the meter Line-to-Line, and a high voltage capacitor is provided to protect from Line-to-Ground. To avoid damaging the MOV protector, maintain continuously applied power voltages within the ratings of the instrument. The mounting flange is a safety ground

for the instrument, and must be connected to a protective earth circuit (refer to Figure 3). Mounting of the MOV board external to the instrument allows easy access so that the MOV and Capacitor may be readily inspected for damage. If the unit is to be powered from a PT, it is recommended that one side of the PT be grounded at the instrument following ANSI/IEEE C57.13.3-1983. The MOV board voltage rating is indicated on the MOV board, and must match the voltage supply rating of the instrument.

3.8 Setting Instrument Address

The PowerPlex RTS Digital Transducer instruments require an address to be set within the instrument before any communications can begin. Refer to the appropriate protocol option manual for address setup instructions.

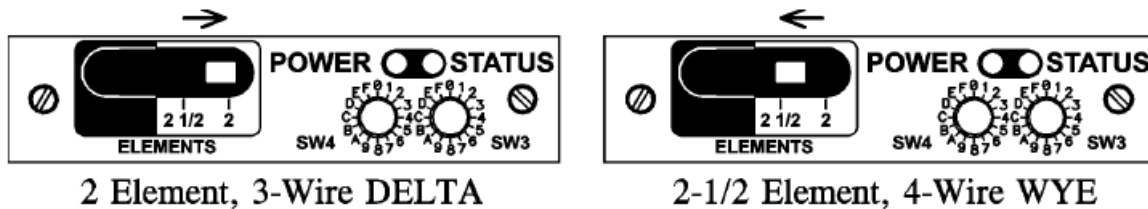


Figure 4 – Element Select Switch Settings

3.9 Setting The Element Select Switch

Bitronics PowerPlex RTS can be connected to 2 Element (3-wire, DELTA), or 2½ Element 4-wire (WYE) systems. This is accomplished by connecting the input signals in the appropriate configuration, as shown in Sec. 6.0, and placing the Element Select Switch in the proper position (Fig. 4). This switch is located on the front panel, behind a clear window. AS THE ELEMENT SELECT SWITCH IS LOCATED ABOVE THE POWER CONNECTIONS, IT IS RECOMMENDED THAT POWER BE REMOVED FROM THE UNIT BEFORE SETTING THE SWITCH. The transducer will not be damaged if the switch is changed with the unit under power. For the correct positioning of the switch, refer to Figure 4.

4.0 FIELD ADJUSTMENTS



WARNING - INSTALLATION AND MAINTENANCE SHOULD ONLY BE PERFORMED BY PROPERLY TRAINED OR QUALIFIED PERSONNEL.

4.1 Rescaling

The PowerPlex RTS Digital Transducer has the capability to store values for Current Transformer (CT) and Potential Transformer (PT) turns ratios. The same PT ratio will be used for both the Line input and the Reference input. The PT and CT values are factory set to 5:5 CT and 1:1 PT. These values can be entered into the PowerPlex RTS over the network, and will be stored in internal nonvolatile memory. Energy values are multiplied by these ratios before they are accumulated. The method of writing these values to the transducer will vary depending on the network protocol. Please refer to the appropriate Interface Option Manual for details.

4.2 Calibration

Routine recalibration is not recommended, or required. However some drift or aging may cause slight errors after years of use. Additionally, users may wish to have a PowerPlex Meter "agree" with other instruments. To accommodate both these instances, a "Master Gain" trimpot has been provided. This trim adjusts the overall scale factor by +/- 10%, and is accessed as follows:

1. Remove the hole plug on the front of the unit. Insert a small screwdriver through the opening, and into the slot of the screw on the trimpot.

- 2a. With the unit powered, AND WITH A PRECISION KNOWN INPUT, rotate the screw clockwise to increase the measurement, or counter-clockwise to decrease the indicated measurement. The PowerPlex transducers can be calibrated with a single phase source; for 2 Element (DELTA) mode the inputs should be connected as shown in Fig 7. Note that the internally generated phase C-A voltage will be the sum of phase A-B and phase B-C. With the connections shown in Figure 7, the A-B and B-C voltages are out of phase (bucking), and therefore will subtract (C-A voltage will be zero). This allows the full input voltage of 150Vac to be applied to the instrument. To check the C-A voltage, the user can apply voltage to either the A-B input (AHI - ALO) or the B-C input (CHI - CLO). If both A-B input (AHI - ALO) and the B-C input (CHI - CLO) are applied in phase, the input voltage should be kept below 75Vac in order to keep from exceeding the 150Vac maximum input level on phase C-A. These restrictions are only for single phase testing.

The phase angle reported in this configuration will be zero degrees, since the A-B input (AHI - ALO) and the Reference input (RHI - RLO) are in phase. If the Reference input (RHI - RLO) is reversed, the instrument should measure +/-180 degrees.

- 2b. When units set to 2½ Element (WYE) Mode are connected to a single phase voltage source, they should be connected as shown in Fig 8. Note that the internally generated phase B voltage will be the sum of phase A and phase C. The input voltage should be kept below 75V ac in this single phase configuration, in

order to keep from exceeding the 150V ac maximum input level on phase B. Additionally, when testing single phase, the phase B current should be reversed as shown in Figure 8 to keep the phase B Watts value the same polarity as phase A and C. Note that with this configuration, the total WATTs and VARs will be 4X the per-phase input value. The Neutral (Residual) Current (in 2½ Element Mode only) is the sum of the three-phase currents. In a single phase configuration the currents will all add in phase, therefore when testing single phase, the phase B current should be reversed as shown. This will yield a Residual (Neutral) current of 5Aac if the Phase currents are all 5A ac ($I_a - I_b + I_c$). These restrictions are only for single phase testing.

The phase angle reported in this configuration will be zero degrees, since the A input (AHI - ALO) and the Reference input (RHI - RLO) are in phase. If the Reference input (RHI - RLO) is reversed, the instrument should measure +/-180 degrees.

4.3 Self Test Modes

The PowerPlex instruments are based on a microcontroller, and therefore can capitalize on the power of such a device. One of the areas where the power of the microcontroller enhances the overall performance of the instrument is in the area of "self-testing". The PowerPlex Digital Transducers have several self tests built in to assure that the instrument is performing accurately. If problems are detected during self test, the appropriate error code is transmitted over the network. See the Interface Options manual for your protocol for details. Table I in the appropriate output option manual lists possible faults that would be detected by the self tests, the effects of the fault, and any necessary corrective actions.

4.4 Cleaning

Cleaning the exterior of the instrument shall be limited to the wiping of the instrument using a soft damp cloth applicator with cleaning agents that are not alcohol based, and are nonflammable, nonexplosive.

5.0 QUESTIONS AND ANSWERS

1. What happens if the applied CT signal exceeds 5A?

The **PowerPlex** transducers are accurate to twice the normal full scale limit (to 10A). The unit will operate at 100% overload without damage and the communications output is still accurate.

2. Is routine calibration necessary?

No, nor is it recommended. More problems are caused by improper calibration than by faulty meters. A calibration check every few years in the field is good assurance, however.

3. HI and LO are marked on the inputs. Does polarity matter?

Yes! Correct wiring with proper polarity is essential for proper operation.

4. Can I put **PowerPlex** transducers in an outdoor cabinet?

Yes. Many Bitronics transducers are installed that way. The temperature range of -20C to 70C covers most applications. The case is not waterproof, so it must be placed within an enclosure that provides ingress protection acceptable for the application in accordance with IEC 529, UL840 or the equivalent NEMA Standard.

5. How long will **PowerPlex** transducers save the CT/PT ratio without power?

The data is saved in a nonvolatile memory (EEPROM) which does not require battery backup. Retention is estimated by the manufacturer to exceed 10 years without refreshing. In any event, long enough to exceed an outage, or for any inactive storage period.

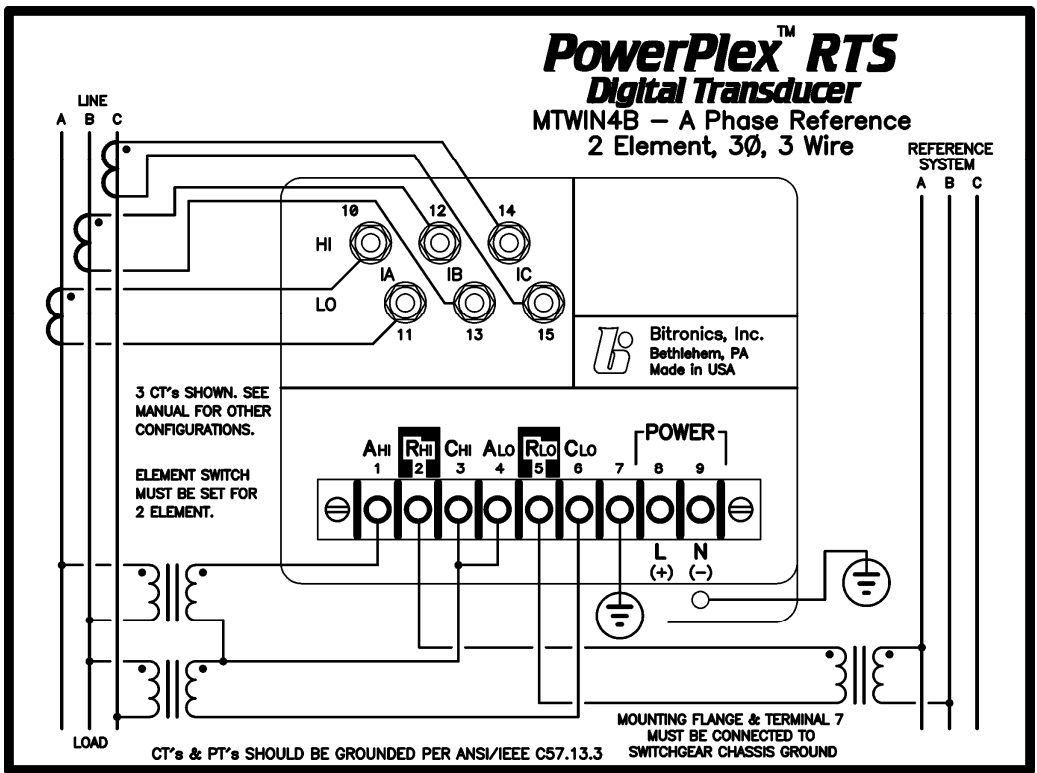


Figure 5 - Typical connection diagram for 2-Element (DELTA) PowerPlex RTS MTWIN4B Multifunction Digital Transducer

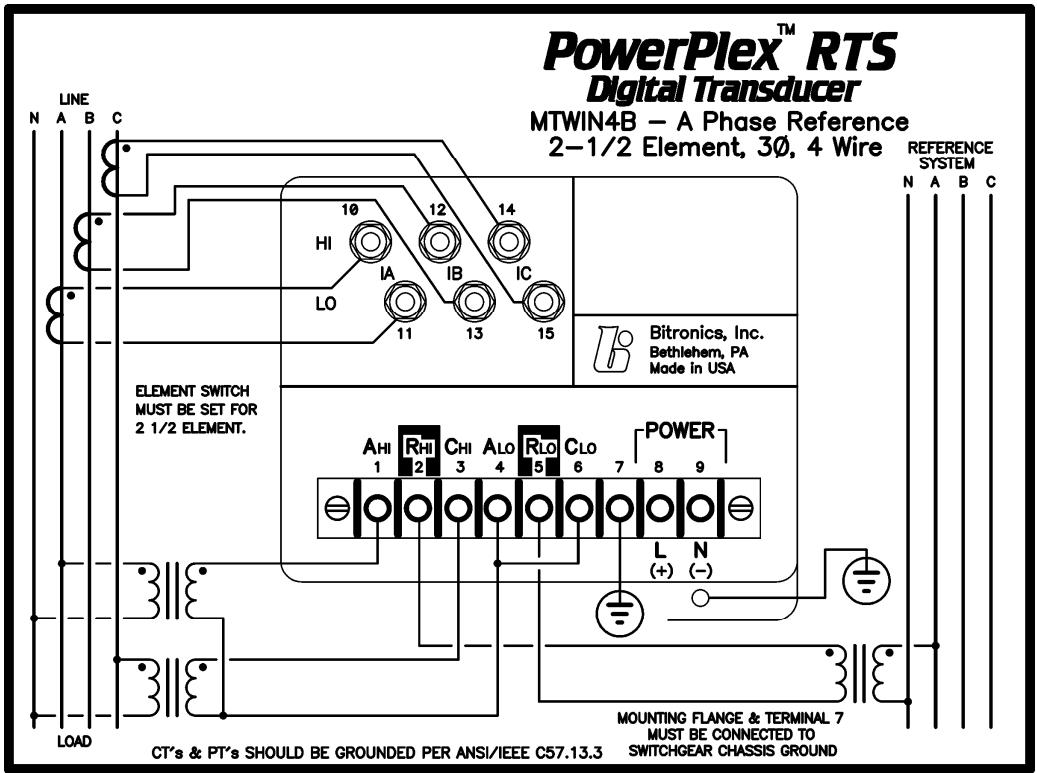


Figure 6 - Typical connection diagram for 2½-Element (WYE) PowerPlex RTS MTWIN4B Multifunction Digital Transducer

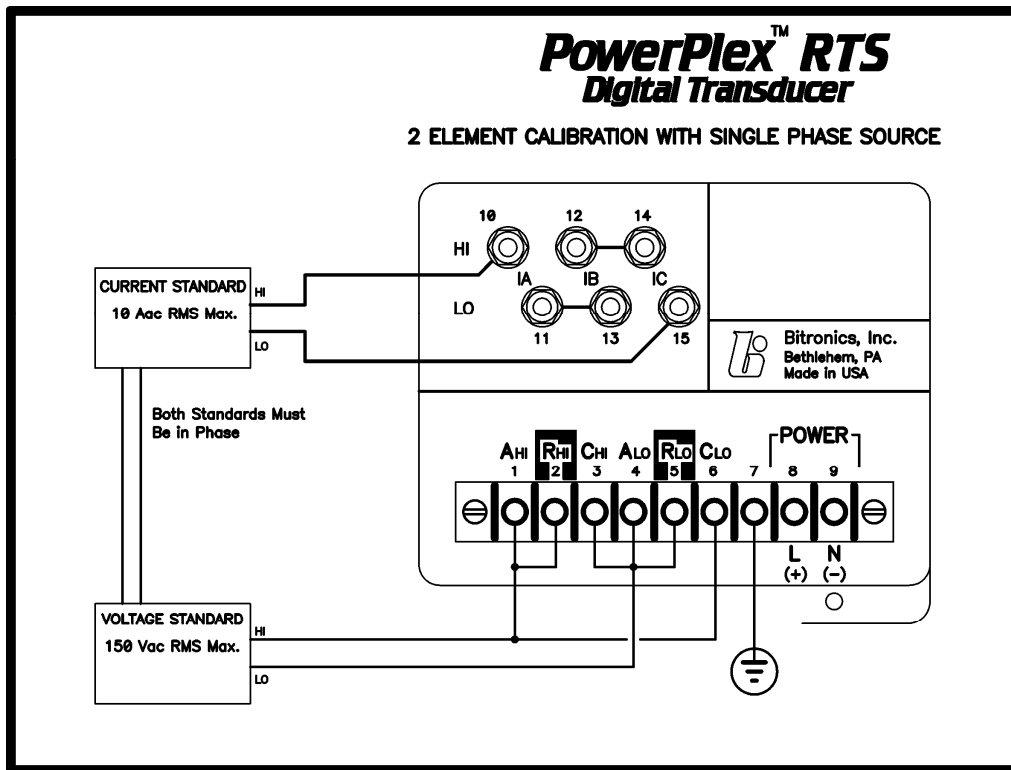


Figure 7 - Connection diagram for testing 2-Element (DELTA) PowerPlex RTS MTWIN4B with Single Phase Source.

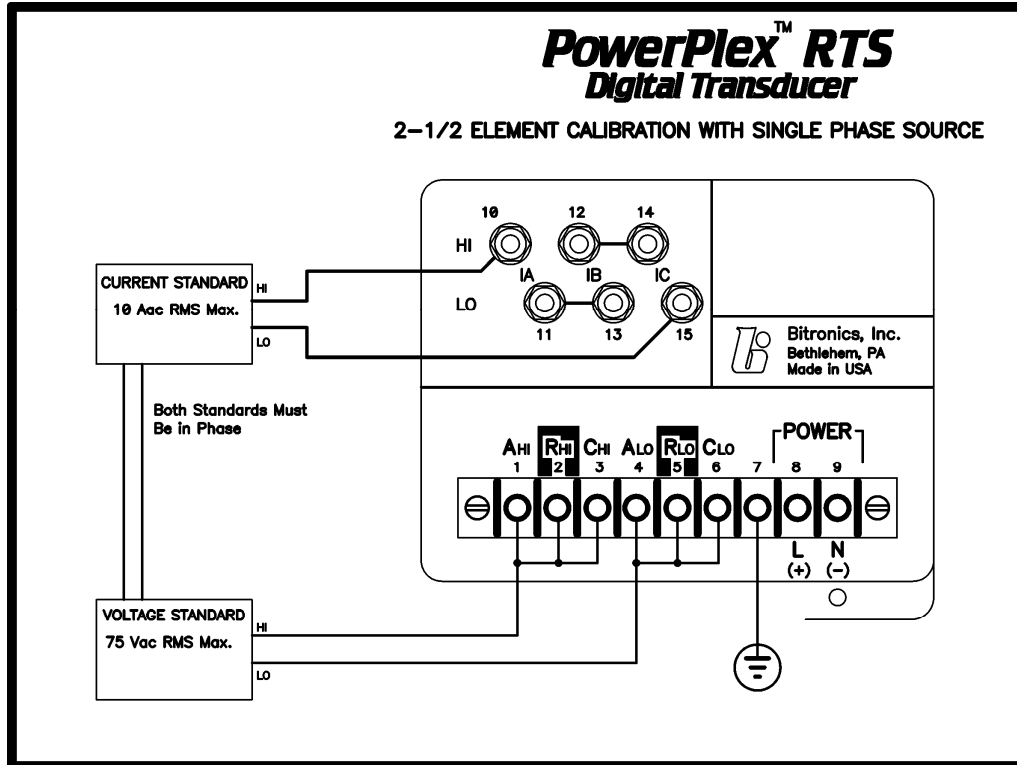


Figure 8 - Connection diagram for testing 2½-Element (WYE) PowerPlex RTS MTWIN4B with Single Phase Source.

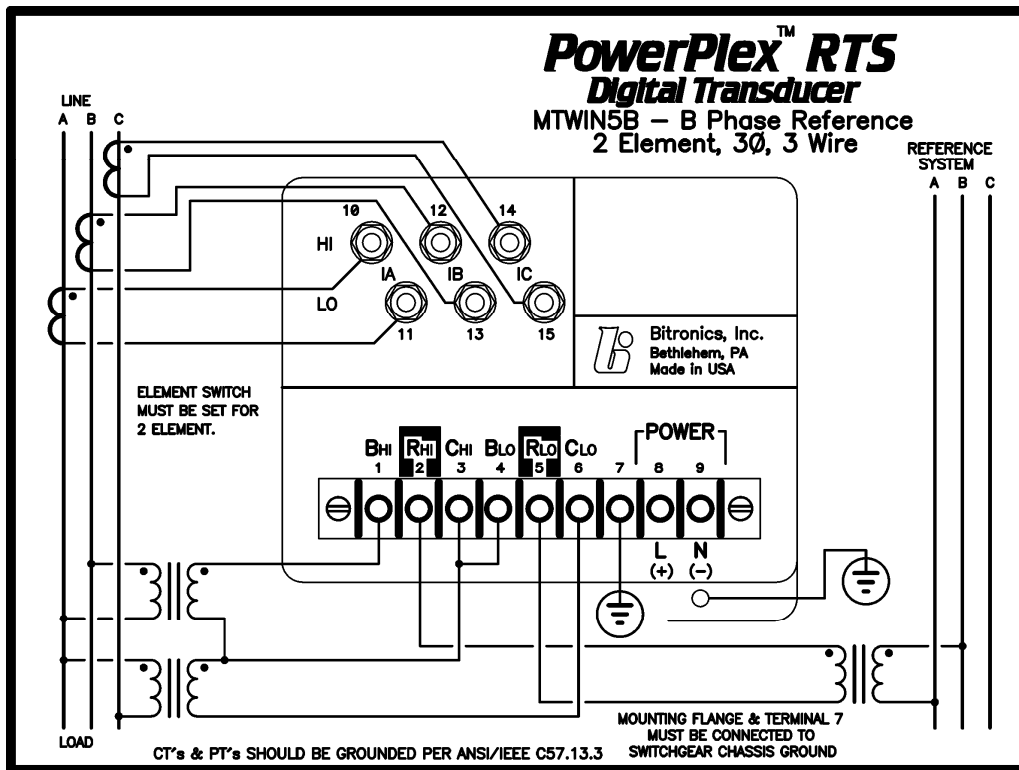


Figure 9 - Typical connection diagram for 2-Element (DELTA) PowerPlex RTS MTWIN5B Multifunction Digital Transducer

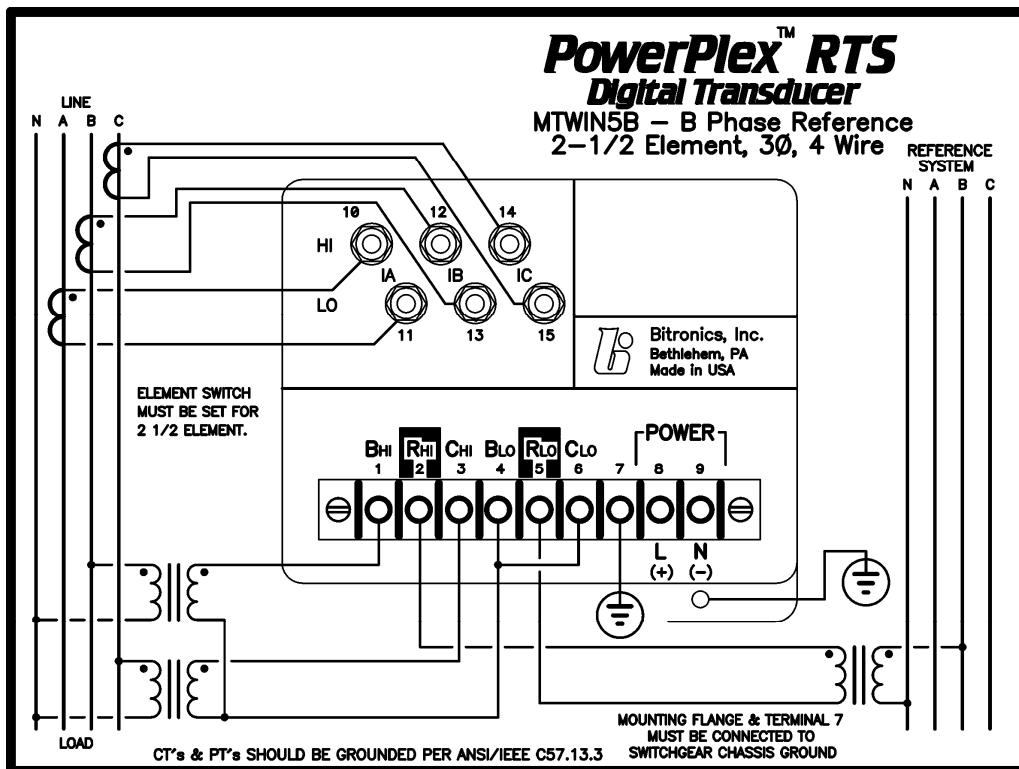


Figure 10 - Typical connection diagram for 2½-Element (WYE) PowerPlex RTS MTWIN5B Multifunction Digital Transducer

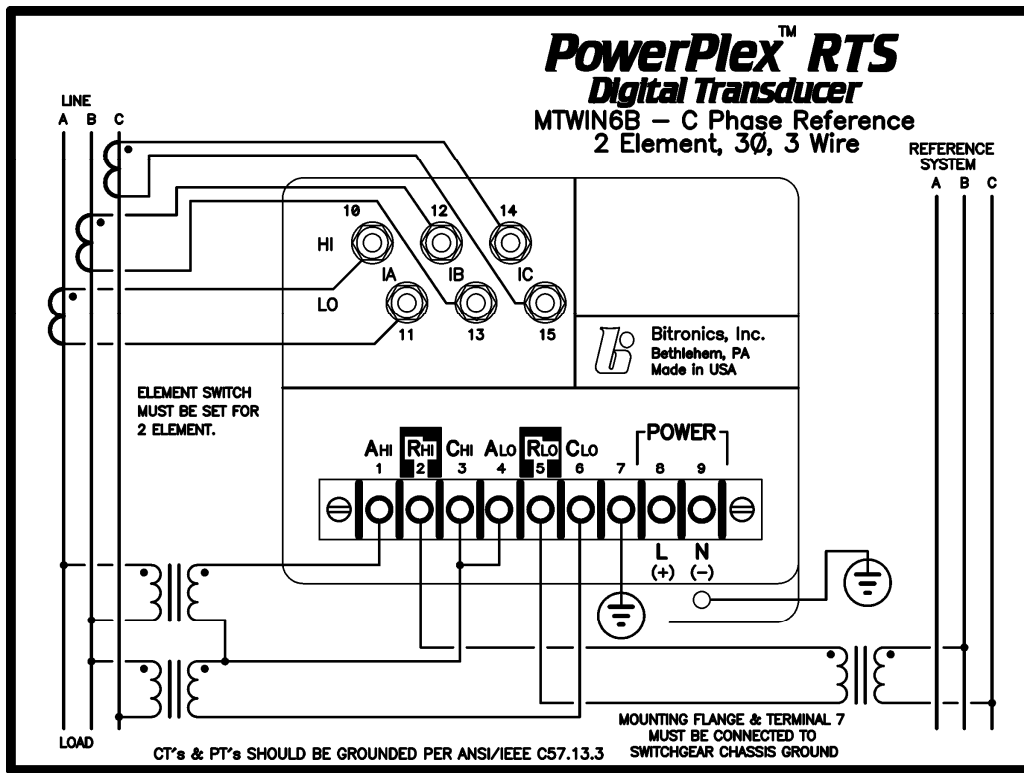


Figure 11 - Typical connection diagram for 2-Element (DELTA) PowerPlex RTS MTWIN6B Multifunction Digital Transducer

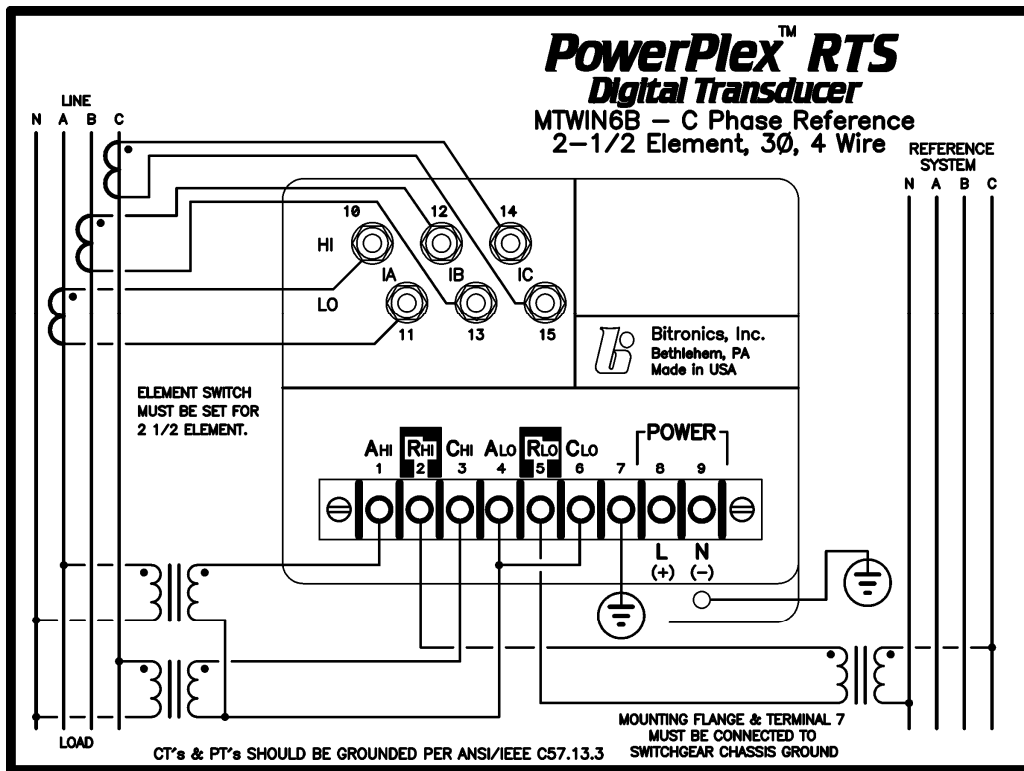


Figure 12 - Connection diagram for testing 2½-Element (WYE) PowerPlex RTS MTWIN6B with Single Phase Source.

Revision	Date	Changes	By
A	01/30/2009	Update Bitronics Name, Logo	E. Demicco
B	10/15/09	Updated logos and cover page	MarCom
C			



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