

DIN AC LVDT Conditioner

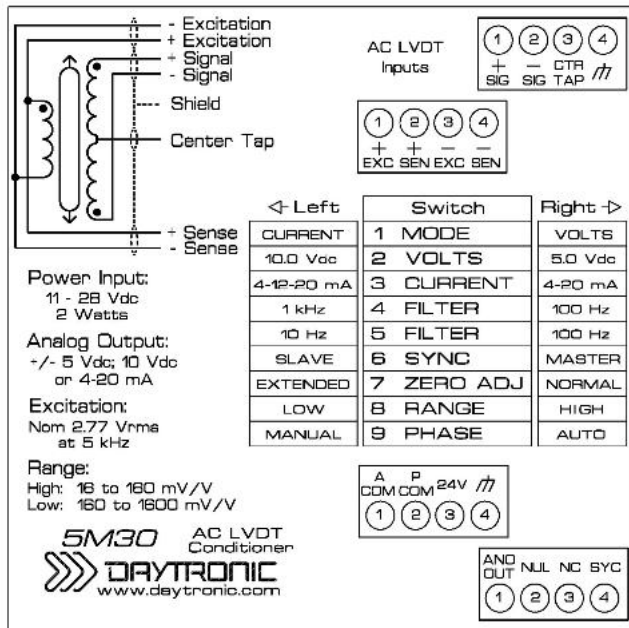
MODEL 5M30

AC LVDT CONDITIONER Module

1 GENERAL DESCRIPTION AND SPECIFICATIONS

The Model 5M30 is a single-channel conditioner of *phase-sensitive carrier-amplifier* design. Intended for applications involving linear variable differential transformer (LVDT) sensors or with the addition of two completion resistors, variable reluctance transducers can be accommodated. The 5M30 will condition and provide a calibrated analog output signal for the measurement of force, load, pressure, displacement and other parameters associated with AC based LVDT sensors. The 5M30 can be used with short or long stroke LVDTs with user selectable gain, zero, automatic or manual phase control and selectable analog output of voltage or current.

The Model 5M30 is calibrated by the "two-point (dead-weight)" process involving known displacement standards, which is outlined in section three.



Model 5M30 AC LVDT Module

Access switch settings via the front panel of the 5M30 by gently pulling the clear plastic cover (from the bottom side) so the cover rotates open from the top. Use a small tool or finger to place the switches to the left or right position as you face the front of the module. This process can be done with or without power to the unit. Once completed, return the cover to the original position.

AC LVDT Phase Operation

Due to the AC modulated aspects of the 5M30 AC Voltage excitation circuit, the 5M30 contains a Manual or Automatic selection for transducer Phase adjustment which aligns the transducer's return output signal to the conditioner's demodulator. When the demodulator is aligned properly through calibration, maximum amplitude and accuracy are achieved.

View of Side Label of the Model 5M30 AC LVDT Module

WARNING

Death, serious injury, or fire hazard could result from improper connection of this instrument. Read and understand this manual before connecting this instrument. Follow all installation and operating instructions while using this instrument.

Connection of this instrument must be performed in compliance with the National Electrical Code (ANSI/NFPA 70-2014) of USA and any additional safety requirements applicable to your installation.

Installation, operation, and maintenance of this instrument must be performed by qualified personnel only. The National Electrical Code defines a qualified person as "one who has demonstrated the skills and knowledge related to the construction and operation of the electrical equipment and installations, and who has received safety training on the hazards involved."

Qualified personnel who work on or near exposed energized electrical conductors must follow applicable safety related work practices and procedures including appropriate personal protective equipment in compliance with the Standard for Electrical Safety Requirements for Employee Workplaces (ANSI/NFPA 70E-2012) of USA and any additional workplace safety requirements applicable to your installation.

ADVERTENCIA

Una conexión incorrecta de este instrumento puede producir la muerte, lesiones graves y riesgo de incendio. Lea y entienda este manual antes de conectar. Observe todas las instrucciones de instalación y operación durante el uso de este instrumento.

La conexión de este instrumento a un sistema eléctrico se debe realizar en conformidad con el Código Eléctrico Nacional (ANSI/NFPA 70-2014) de los E.E.U.U., además de cualquier otra norma de seguridad correspondiente a su establecimiento.

La instalación, operación y mantenimiento de este instrumento debe ser realizada por personal calificado solamente. El Código Eléctrico Nacional define a una persona calificada como "una que esté familiarizada con la construcción y operación del equipo y con los riesgos involucrados."

El personal cualificado que trabaja encendido o acerca a los conductores eléctricos energizados expuestos debe seguir prácticas y procedimientos relacionados seguridad aplicable del trabajo incluyendo el equipo protector personal apropiado en conformidad con el estándar para los requisitos de seguridad eléctricos para los lugares de trabajo del empleado (ANSI/NFPA 70E-2012) de los E.E.U.U. y cualquier requisito de seguridad adicional del lugar de trabajo aplicable a su instalación.

AVERTISSEMENT

Si l'instrument est mal connecté, la mort, des blessures graves, ou un danger d'incendie peuvent s'en suivre. Lisez attentivement ce manuel avant de connecter l'instrument. Lorsque vous utilisez l'instrument, suivez toutes les instructions d'installation et de service.

Cet instrument doit être connecté conformément au National Electrical Code (ANSI/NFPA 70-2014) des Etats-Unis et à toutes les exigences de sécurité applicables à votre installation.

Cet instrument doit être installé, utilisé et entretenu uniquement par un personnel qualifié. Selon le National Electrical Code, une personne est qualifiée si "elle connaît bien la construction et l'utilisation de l'équipement, ainsi que les dangers que cela implique".

Le personnel qualifié qui travaillent dessus ou s'approchent des conducteurs électriques activés exposés doit suivre des pratiques en matière et des procédures reliées par sûreté applicable de travail comprenant le matériel de protection personnel approprié conformément à la norme pour des conditions de sûreté électriques pour les lieux de travail des employés (ANSI/NFPA 70E-2012) des Etats-Unis et toutes les conditions de sûreté additionnelles de lieu de travail applicables à votre installation.

WARNUNG

Der falsche Anschluß dieses Gerätes kann Tod, schwere Verletzungen oder Feuer verursachen. Bevor Sie dieses Instrument anschließen, müssen Sie die Anleitung lesen und verstanden haben. Bei der Verwendung dieses Instruments müssen alle Installation- und Betriebsanweisungen beachtet werden.

Der Anschluß dieses Instruments muß in Übereinstimmung mit den nationalen Bestimmungen für Elektrizität (ANSI/NFPA 70- 2014) der Vereinigten Staaten, sowie allen weiteren, in Ihrem Fall anwendbaren Sicherheitsbestimmungen, vorgenommen werden.

Installation, Betrieb und Wartung dieses Instruments dürfen nur von Fachpersonal durchgeführt werden. In dem nationalen Bestimmungen für Elektrizität wird ein Fachmann als eine Person bezeichnet, welche "mit der Bauweise und dem Betrieb des Gerätes sowie den dazugehörigen Gefahren vertraut ist."

Qualifiziertes Personal, das an bearbeiten oder herausgestellte angezogene elektrische Leiter sich nähern, muß anwendbare Sicherheit bezogener Arbeit Praxis und Verfahren einschließlich passende persönliche schützende Ausrüstung gemäß dem Standard für elektrische Sicherheitsauflagen für Angestellt-Arbeitsplätze (ANSI/NFPA 70E-2012) der Vereinigten Staaten und alle zusätzlichen Arbeitsplatzsicherheitsauflagen folgen, die auf Ihre Installation anwendbar sind.

Safety Precautions

The following safety precautions must be followed whenever any type of voltage or current connection is being made to the instrument.

- Before connecting to electric circuits or pulse initiating equipment, open their related breakers or disconnects. It is recommended NOT TO install any connection of the instrument on live power lines. Only Qualified Service personnel that have demonstrated the abilities and received the proper safety training are capable of connecting to live circuits.
- Connections must be made to the instrument first, then connect to the circuit to be monitored.
- Wear proper personal protective equipment, including safety glasses and insulated gloves when making connections to power circuits.
- Hands, shoes and floor must be dry when making any connection to a power line.
- Before each use, inspect all cables for breaks or cracks in the insulation. Replace immediately if defective.
- If the equipment is used in a manner not specified in this user's guide, the protection provided by the equipment may be impaired.

Medidas de seguridad

Las medidas de seguridad siguientes deberán observarse cuando se realice cualquier tipo de conexión al instrumento.

- o Cuando se haga conexiones a circuitos eléctricos o a equipo de activación por pulso, deberá abrirse sus respectivas cajas de seguridad. NO deberá hacerse ninguna conexión del instrumento en líneas eléctricas bajo tensión.
- o Las conexiones deberán hacerse primero al instrumento y, luego, al circuito a ser monitorizado.
- o Al hacer conexiones a circuitos eléctricos, deberá utilizar anteojos y guantes protectores.
- o Sus manos, zapatos y el piso deberán estar secos en todo momento en que se haga una conexión a un cable eléctrico.
- o Verifique que la unidad esté DESACTIVADA antes de conectar sondas en el panel posterior.
- o Previo a cada uso, deberá verificarse que los cables no estén rotos y que el material aislante no tenga rajaduras. Reemplace de inmediato cualquier parte defectuosa.

Mesures de Sécurité

Les mesures de sécurité suivantes doivent être prises chaque fois qu'un type de connexion quelconque est effectué sur l'instrument.

- o Ouvrir les disjoncteurs correspondants lors d'une connexion à des circuits électriques ou à des équipement de génération d'impulsions. NE PAS effectuer de connexion d'instrument sur des lignes électriques sous tension.
- o Une fois toutes les connexions de l'instrument effectuées, connecter au circuit à contrôler.
- o Porter des lunettes de protection et des gants isolants pour effectuer des connexions aux circuits électriques.
- o S'assurer que les mains, les chaussures et le sol soient secs lors de connexions à une ligne électrique.
- o S'assurer que l'unité est ÉTEINTE avant de connecter les sondes au panneau arrière.
- o Inspecter tous les câbles, avant chaque utilisation, pour s'assurer que les isolants ne sont pas coupés ou fendus. Remplacer immédiatement tous les équipements défectueux.

Sicherheitsvorkehrungen

Die folgenden Sicherheitsvorkehrungen sind immer dann zu befolgen, wenn eine Verbindung zum Instrument hergestellt wird.

- o Öffnen Sie beim Anschluß an elektrische Stromkreise oder Impulsauslösungseinrichtungen die entsprechenden Unterbrecher. Es dürfen KEINE Anschlüsse an das Instrument unter stromführenden Spannungsleitungen montiert werden.
- o Die Verbindungen müssen zuerst am Instrument und danach an der zu überwachenden Schaltung hergestellt werden.
- o Tragen Sie Schutzbrillen und Isolierhandschuhe, wenn Sie Anschlüsse an den Stromkreisen vornehmen.
- o Hände, Schuhe und Fußboden müssen trocken sein, wenn Sie Anschlüsse an den Stromkreisen durchführen.
- o Stellen Sie sicher, daß das Gerät AUSgeschaltet ist, bevor Sie an der rückwärtigen Konsole Meßfühler anschließen.
- o Prüfen Sie vor jedem Gebrauch alle Kabel auf Bruchstellen und Risse in der Isolierung. Wechseln Sie schadhafte Kabel sofort aus.

Standard Accessories

Standard accessories

The following table lists the 5M standard accessories.

Description	Part Number
Manual & Operating instruction	Resource CD

5M30 AC LVDT Module

5M30 SPECIFICATIONS

Measurement Range: Adjustable; 16 to 160 or 160 to 1600 mV/V; nominal full-scale

Transducer Types: 4 or 5 wire AC LVDT, or Variable Reluctance with the addition of two completion resistors (1k Ohm) as shown in Fig. 2

Excitation: 5.00 KHz; Nominal 2.77 Vac rms up to 70 mA, sensed

Power Supply : 11 - 28 Vdc regulated; 2 watts max.

Analog Output : selectable; ± 0 to 5, ± 0 to 10 Vdc, 4-20mA or 4-12-20mA (20% overrange in voltage mode only)

Operating Temperature : -10 to +70 Degrees C, 5 to 95% relative humidity, non-condensing

Amplifier

Normal - Mode Range: ± 5 V rms operating; ± 28 V without instrument damage

Input Impedance : Differential 200 k Ω

Offset : vs. Temperature: ± 30 ppm μ V/ $^{\circ}$ C; vs. Time: ± 10 ppm/month

Gain Accuracy : Limited only by calibration accuracy

Gain Stability : vs. Temperature: ± 30 ppm/ $^{\circ}$ C; vs. Time: ± 10 ppm/month

Linearity: better than $\pm 0.03\%$ of full scale

Filter: 3-pole modified Butterworth; 3 dB down at 10 Hz, 100 Hz or 1 kHz; selectable

Step-Response Settling Time (Full-Scale Output @ 10 Hz)

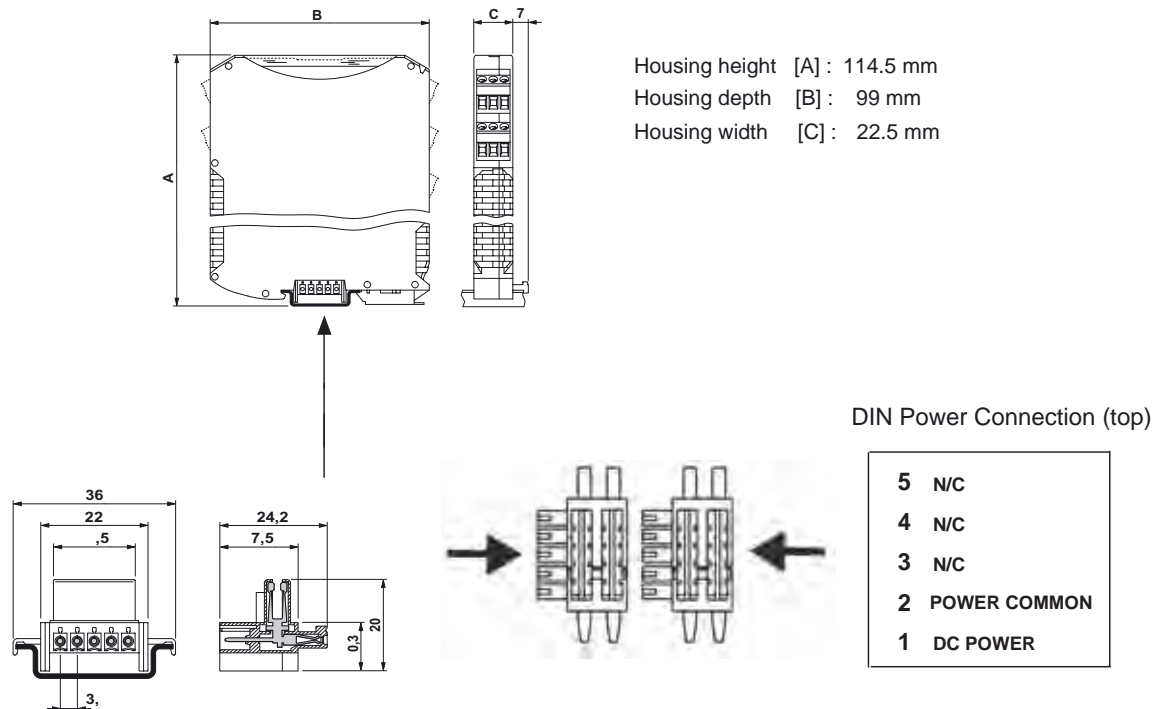
To 1% of final value: 0.08 sec; (0.008 sec @ 100 Hz) (0.0008 sec @ 1 kHz)

To 0.1% of final value: 0.095 sec; (0.0095 sec @ 100 Hz) (0.00095 sec @ 1 kHz)

To 0.02% of final value: 0.100 sec; (0.010 sec @ 100 Hz) (0.0012 sec @ 1 kHz)

Dimensions

Dimensional drawing



Optional DIN Power Rail Connector Model 5M-PCON

2 TRANSDUCER CONNECTIONS

The Model 5M30 I/O CONNECTIONS are via non-removable screw terminals which will accept wire sizes from AWG 12 to 26. **NOTE:** The recommended transducer cabling would be eight wire, individually shielded, twisted pair - wired as indicated (Fig. 1) Sense lines must be connected at the transducer (as recommended) or at the 5M30 screw terminals - as a minimum. Table 2 denotes screw terminal assignments

Table 2 Model 5M30 Pin Assignments

I/O Connector Pin Number	Screw Terminal	Terminal Label	Conditioner Line Function
Top Rear 1	1	+ EXC	+ EXCITATION
Top Rear 2	2	+ SEN	+ SENSE
Top Rear 3	3	- EXC	- EXCITATION
Top Rear 4	4	- SEN	- SENSE
Top Front 1	1	+ SIG	+ SIGNAL Input
Top Front 2	2	- SIG	-SIGNAL Input
Top Front 3	3	CTR TAP	CENTER TAP (GRD)
Top Front 4	4	⎓	SHIELD
Bottom Front 1	1	Ano Out	ANALOG Output
Bottom Front 2	2	NUL	Null Control
Bottom Front 3	3	NC	No Connection
Bottom Front 4	4	SYC	SYNC - MASTER/SLAVE
Bottom Rear 1	1	Acom	Analog Common
Bottom Rear 2	2	Pcom	Power Common
Bottom Rear 3	3	24 V	24 Vdc Power
Bottom Rear 4	4	⎓	SHIELD

Fig. 1 Model 5M30 Transducer Cabling - AC LVDT

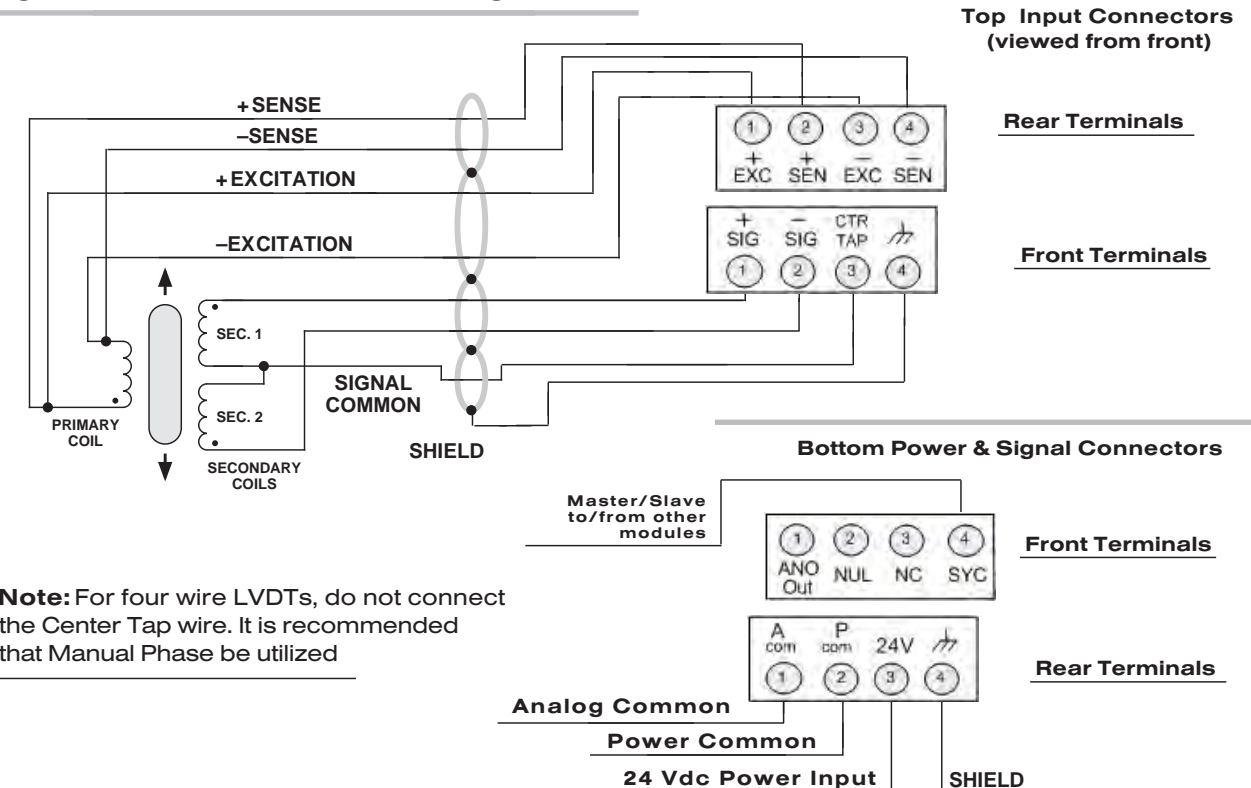
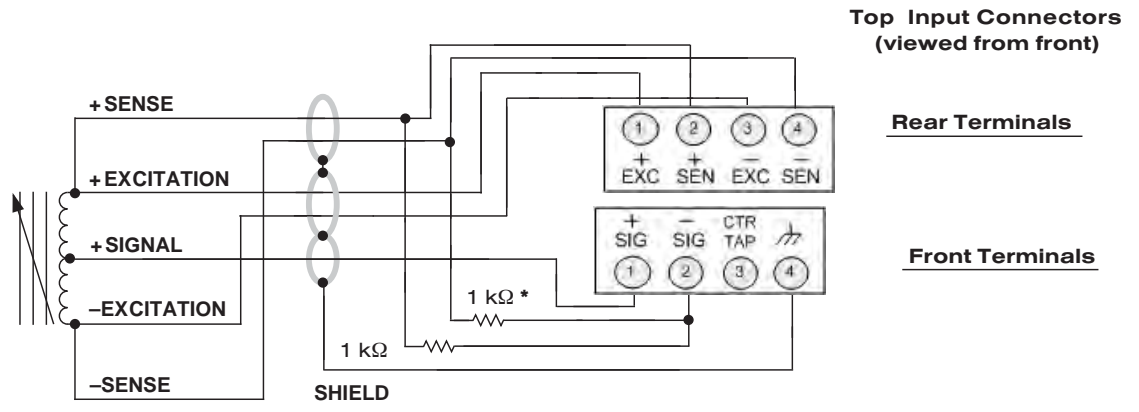


Fig. 2 Model 5M30 Transducer Cabling Variable Reluctance



* User installed completion resistors

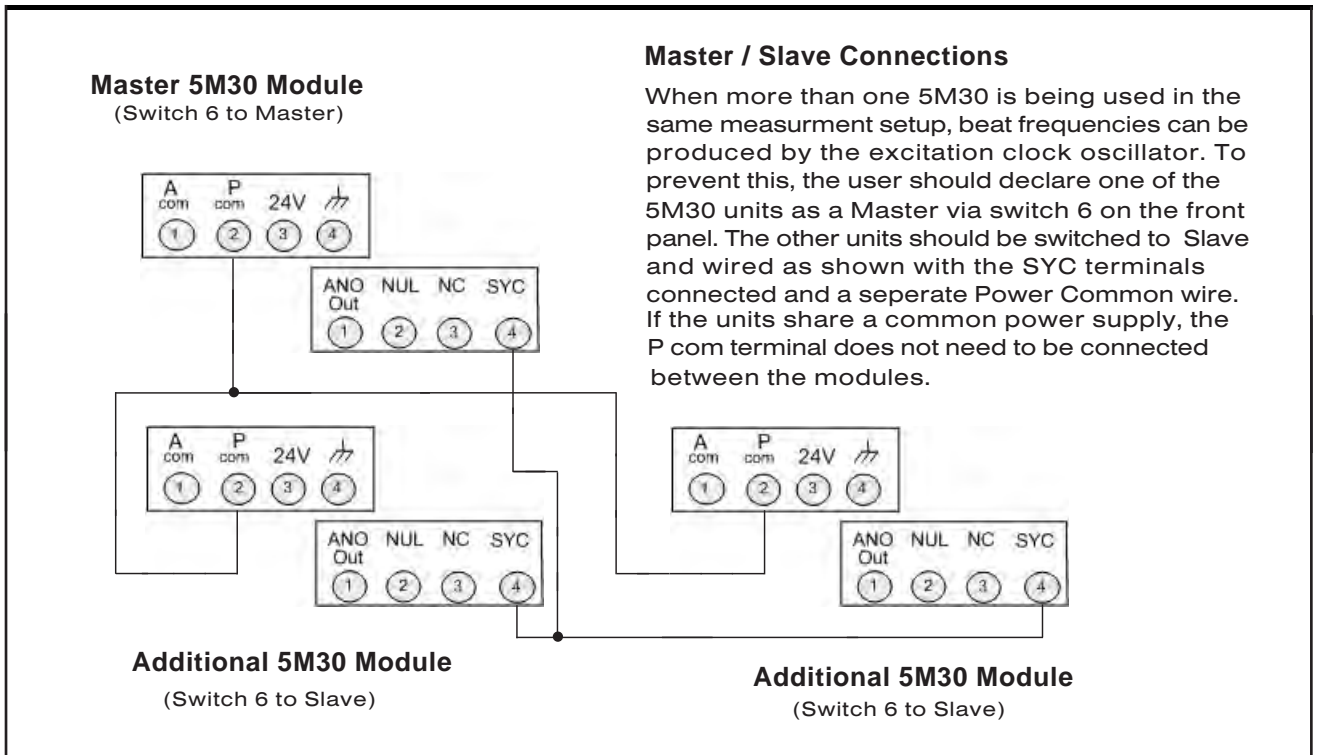


Fig. 3 Master / Slave Wiring

4. CALIBRATION

This section contains the instructions for calibrating the 5M30. Included is a functional description of the instrument front-panel (see Figure 3). To perform calibration, proceed as follows.

- (a) Connect Power, Sensor and Analog terminals as required. Turn power ON. The front-panel indicator should light green to indicate the application of DC power. Allow 10 minutes of warmup for stabilization of transducer characteristics. Open the clear plastic front cover of the 5M30 unit.
- (b) Set the Coarse Zero and Span controls to the default calibration position as indicated (<, MIN>)
- (c) Position the front panel switches to the desired settings for the application. Refer to Figure 4 for details.
- (d) If this is the system's first calibration, it is advised to jumper the terminal label "NUL" to "Power Common". This will defeat any conditioner zero and allow the user to reliably find the "Null" or electrical "Zero" position of the LVDT. With the jumper in place, mechanically adjust the LVDT or sensor to its most minimum analog output value. This will be mechanical Null.
- (e) With mechanical Null established, remove the "NUL" to "Power Common" jumper. Adjust Coarse and Fine Zero for Zero Output. From the mechanical Null reference position, enable your span reference standard (gage block, micrometer, etc.). Adjust the Coarse Span control until you achieve a nominal full scale analog output value. If the 5M30 is in the Manual Phase Mode, adjust the Phase control to obtain the highest magnitude on the analog output. If the 5M30 is in "Auto" Phase mode, this is accomplished automatically. (Due to cable length and typically with long stroke LVDTs, the unit may require Manual Phase adjustment to achieve the desired precision). Once Phase has been accomplished, the 5M30 will not need to be re-phased for subsequent calibrations unless the cable or the transducer are replaced. Adjust Fine Span and Coarse Span, as needed, for the precise full scale analog output desired.
- (f) Return the sensor to the "Zero" position (which may or may not be Null) and adjust the Coarse Zero and Fine Zero controls for the desired output. If the sensor requires additional Zero authority, place Switch 7 in the Extended position (100% offset) authority (see tech tip note). Normal setting is approx. 25% of span range.
- (g) Re-apply the Full Scale condition stated in step (e). Adjust Coarse and Fine Span controls to achieve the desired output. Note that changes in Span will effect Zero. Span and Zero re-adjustments may need to be repeated to obtain the desired analog output value.
- (h) For Negative Span adjustment, place the sensor in the opposite full scale position and adjust the Symmetry control for the desired output analog value.

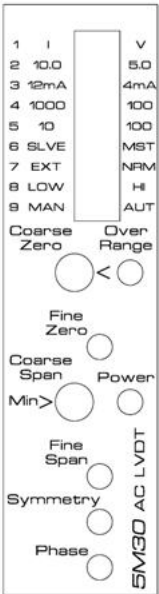
3 CALIBRATION (cont.)

- (i) Once completed, replace the front plastic cover to the original position and ensure proper shielding and grounding have been done to the module and to the DIN rail used for mounting of the 5M30.

Null Calibration Check The instrument can be placed in the calibration mode by shorting "NUL" and Power Common terminals. This will defeat any zero function in the 5M30 to allow the user to establish a true "Null" or electrical zero position of the sensor. From this mechanical / electrical position, Full Scale positive and negative reference points can be obtained allowing the user the full linear operating range of the sensor and the 5M30 conditioner.

Master/Slave Connections. When more than one 5M30 is being used in a measurement setup (instruments are closely mounted or the transducer cabling is in a common conduit or raceway), beat frequencies may be produced from the 5-kHz oscillators used in the instruments to develop the excitation. To prevent beat frequencies from occurring, one unit can be designated the master, and the remaining units can be driven from the oscillator contained in the master unit. The remaining units are designated as slave instruments. To perform master/slave wiring, refer to Figure 3.

Phase & Signal Reversal: The manual phasing signal is derived from the excitation circuit. Therefore when doing signal reversal (typically positive displacement is a positive signal) must be accomplished by reversing the signal leads, not the excitation & sense leads from the transducer to the conditioner.



The diagram shows the front panel of the 5M30 AC LVDT conditioner. It features a vertical column of 9 switches labeled 1 through 9. To the right of these switches are two columns of labels: the first column lists 'I', 'V', '5.0', '4mA', '100', '100', 'MST', 'NFM', 'HI', 'AUT' and the second column lists 'Coarse Zero', 'Over Range', 'Fine Zero', 'Coarse Span', 'Power', 'Min>', 'Fine Span', 'Symmetry', 'Phase'. Below the switches are two potentiometers labeled 'Coarse Zero' and 'Fine Zero', and two more potentiometers labeled 'Coarse Span' and 'Fine Span'. At the bottom are two potentiometers labeled 'Symmetry' and 'Phase'. The text '5M30 AC LVDT' is printed vertically on the right side of the panel.

- Switch 1 - Mode** - selects current (I) or voltage analog output
- Switch 2 - Volts** - selects +/- 5 or +/- 10 Vdc when mode is voltage
- Switch 3 - Current** - selects 4-12-20 or 4-20mA when mode is current
- Switch 4 - Filter** - selects 1kHz or 100 Hz at 3 dB, for 100 Hz switch 5 must be set to the right
- Switch 5 - Filter** - selects 10 Hz or 100 Hz at 3 dB, for 100 Hz switch 4 must be set to the right
- Switch 6 - Sync** - selects excitation clock to slave from a master module or to be master
- Switch 7 - Zero Adj.** - selects Extended (100%) or Normal (20%) zero authority
- Switch 8 - Range** - selects gain: Low (160-1600) or High (16 - 160) mV/V sensors
- Switch 9 - Phase** - selects Automatic or Manual Phase adjustment
- Coarse Zero** - 16 position switch adjustment for stepped zero balance control
default calibration position indicated by "<"
- Fine Zero** - 18 turn potentiometer for fine zero balance control
- Coarse Span** - 16 position switch adjustment for stepped gain control
default calibration position indicated by "MIN>"
- Fine Span** - 18 turn potentiometer for fine gain - span control
- Symmetry** - adjust the negative output span to be equal with the positive output
- Phase** - adjustment for phasing the AC modulated signal to its highest level at F.S.
- Over Range** - indicates when the analog output is 2% greater than mode selected
- Power** - indicates the power input voltage is ON

Fig. 4 Front Panel Settings and Indicators

Tech Tip on use of wide zero values for the 5M30 Conditioner (Switch 7)

If the large zero offset is used to correct for an offset within the transducer, no special calibration considerations need to be used beyond the normal two point calibration. If, however a large offset from the transducer's "native" zero is desired (e.g. -60% to +100% of the transducer mechanical range is to calibrate to 0 to 5 Volts output), the steps below can ease the process considerably.

Note also that if the current output is chosen, then using the 4-12-20 ma choice effectively offsets - 100% full scale.

- (a) Choose the mechanical stimulation end points and calculate their difference in percent of the transducer's full scale range.
- (b) Multiply the transducer's full scale electrical output by the value obtained in (a) and verify that it does not exceed the allowable signal range for the conditioner.
- (c) Stimulate the transducer to mechanical zero and use the coarse and fine zero controls to achieve zero output from the conditioner.
- (d) Stimulate the transducer to a mechanical value of **one half** of the value obtained in step (a) and use the coarse and fine span controls to set the conditioner output to **one half** of full scale.
- (e) Repeat steps (c) and (d) as needed.
- (f) Stimulate the transducer to the mechanical low end point and use the symmetry control to set the conditioner output to one half times the ratio of the percent of transducer full scale represented by the low end point and the value from step (a).
- (g) Repeat steps (c), (d), and (f) as needed.
- (h) Stimulate the transducer to the mechanical low end point again and use the coarse and fine zero controls to set the output to zero.
- (i) Stimulate the transducer to the mechanical high end point and use the coarse and fine span controls to set the output to full scale.
- (j) Repeat steps (h) and (i) as needed.

Example for +/- 100% of mechanical transducer range to cause zero to full scale output. Step (a) would be a value of 200%. Step (b), if the transducer outputs +/- 2 mV/V/milli-inch and the stroke is +/- 100 milli-inches then 200% is 400 mV/V which is compatible on the low gain setting. Step (d) one half of that is 100% - set 100 milli-inch positive mechanical stimulation to one half full scale output. Step (f), the mechanical low end point is - 100 miil-inch and the ratio is -100% to +100% thus -1 times 1/2 = -50% or 2.5 Volts out on the 5 Vdc output range of the condtioner.

Example for -60% to +100% of mechanical transducer range to cause zero to full scale output. Step (a) would be a value of 160%. Step (b), if the transducer outputs +/- 2 mV/V/milli-inch and the stroke is +/- 50 milli-inches then 160% is 160 mV/V which is compatible on either gain setting. Step (d) one half of that is 80% - set -40 milli-inch positive mechanical stimulation to one half full scale output. Step (f), the mechanical low end point is - 30 miil-inch and the ratio is -60% to +80% thus -60/80 = .75 times 1/2 = -37.5% or -1.875 Volts out on the 5 Vdc output range of the condtioner.

Product Warranty and Repair

Daytronic Corporation warrants its products to be free from defects in material and workmanship, under normal and proper use in accordance with our instructions, for the period of time specified below. Our liability under such warranty or in connection with any other claim relating to the products shall be limited to, at our option, the repair or replacement of any products or parts or components thereof which are returned to us freight prepaid and which are defective in material or workmanship or the refund of the purchase price to the Buyer.

ANY PRODUCT FOUND TO BE DAMAGED THROUGH CUSTOMER NEGLIGENCE OR MIS-USE MAY BE EXCLUDED FROM ANY AND ALL POLICIES CONTAINED IN THIS DOCUMENT.

ALL EQUIPMENT TO BE REPAIRED OR REPLACED UNDER WARRANTY MUST BE RETURNED TO THE FACTORY. Before returning a product or products for any reason, the customer must call **Daytronic Customer Support Services** at **(937) 866-3300** to request a *RETURN MATERIAL AUTHORIZATION (RMA)*. Once the customer has provided the necessary information and has been assigned a specific RMA, the product(s) in question may be returned to Daytronic by shipping it

Daytronic Corp. , 1000 New Durham Road, Edison, New Jersey 08818

Daytronic Customer Service: 1-800-668-4745 service@daytronic.com



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