DIN Frequency Conditioner

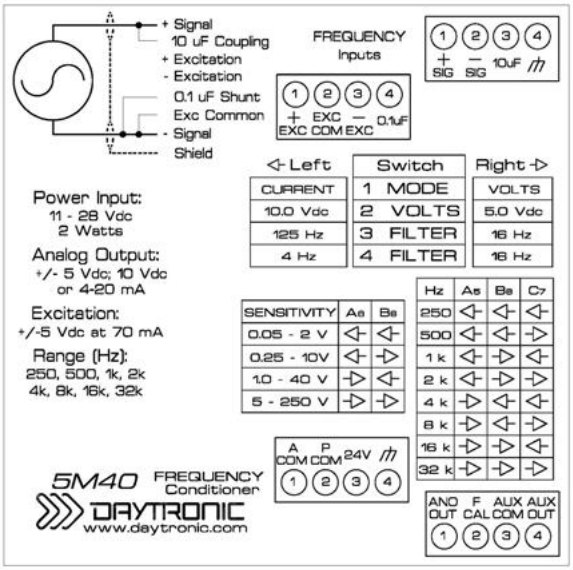
Model 5M40

Frequency Conditioner Module

1 General Description and Specifications

The Model 5M40 is a single-channel conditioner which accepts any AC or unipolar pulse input, irrespective of waveform, from turbine flow meters, magnetic pick ups or similar frequency-generating transducers. The frequency source can be grounded or floating. For environments which may have high frequency noise or a DC offset on the input signal, the 5M40 contains input suppression and DC offset capacitive coupled signal terminals. When used with an open-collector type sensor, the 5M40 requires a pull-up resistor (typically 10k Ohms) between + Signal and + Excitation.

The Model 5M40 is calibrated by means of a "two-point (dead-weight)" process involving a known frequency standard or through the use of the "F CAL" reference provided.



Model 5M40 Frequency Module

Access switch settings via the front panel of the 5M40 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.

Sensitivity Operation

The 5M40 contains four selectable input sensitivity ranges which allows the user to accommodate input signal levels to the 5M40's "Smart Schmitt" trigger circuit for signals as low as 50 millivolts (i.e. low flow turbine meters) and up to inputs as high as 250 Volts as seen in magnetic speed sensors.

View of Side Label of the Model 5M40 Frequency 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.

- 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.

- Las conexiones deberán hacerse primero al instrumento y, luego, al circuito a ser monitorizado.

- Al hacer conexiones a circuitos eléctricos, deberá utilizar anteojos y guantes protectores.

- Sus manos, zapatos y el piso deberán estar secos en todo momento en que se haga una conexión a un cable eléctrico.

- Verifique que la unidad esté DESACTIVADA antes de conectar sondas en el panel posterior.

- 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.

- 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.

- Une fois toutes les connexions de l'instrument effectuées, connecter au circuit à contrôler.

- Porter des lunettes de protection et des gants isolants pour effectuer des connexions aux circuits électriques.

- S'assurer que les mains, les chaussures et le sol soient secs lors de connexions à une ligne électrique.

- S'assurer que l'unité est ÉTEINTE avant de connecter les sondes au panneau arrière.

- 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.

- Öffnen Sie beim Anschluß an elektrische Stromkreise oder Impulsauslösungseinrichtungen die entsprechenden Unterbrecher. Es dürfen KEINE Anschlüsse an das Instrument unter stromführenden Spannungsleitungen montiert werden.
- Die Verbindungen müssen zuerst am Instrument und danach an der zu überwachenden Schaltung hergestellt werden.
- Tragen Sie Schutzbrillen und Isolierhandschuhe, wenn Sie Anschlüsse an den Stromkreisen vornehmen.
- Hände, Schuhe und Fußboden müssen trocken sein, wenn Sie Anschlüsse an den Stromkreisen durchführen.
- Stellen Sie sicher, daß das Gerät AUSgeschaltet ist, bevor Sie an der rückwärtigen Konsole Meßfühler anschließen.
- 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

5M40 Specifications

Measurement Range: Adjustable; 250 Hz to 32 kHz; nominal full-scale

Transducer Types: Any AC or Unipolar pulse signal, grounded or floating, regardless of waveform

Excitation: 10 Vdc (+/- 5 Vdc) ± 2% up to 70 mA

Power Supply : 11 - 28 Vdc regulated; 3.6 watts max.

Analog Ouput : selectable; ± 0 to 5, ± 0 to 10 Vdc or 4-20mA. (20% over-range in voltage mode only)

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

Amplifier

Common - Mode Range: 125 V rms

Input Impedance: Greater than 200 kΩ on all ranges

Offset : vs. Temperature: ±30 ppm µV/°C; vs. Time: ±10 ppm/month

Gain Accuracy: ±0.02% full scale, typical, following calibration

Gain Stability: vs. Temperature: ±30 ppm/°C; vs. Time: ±10 ppm/month

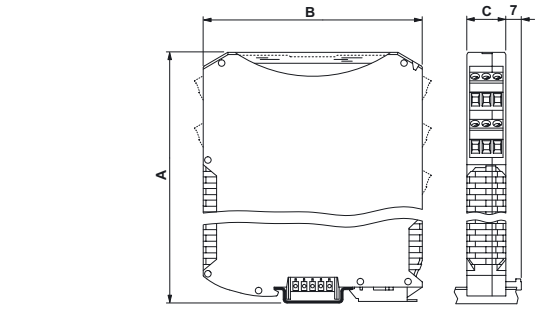
Filter: 9-pole modified Butterworth; 3 dB down at 4 Hz, 16 Hz or 125 Hz; selectable

Step-Response Settling Time (Full-Scale Output @ 4 Hz :)

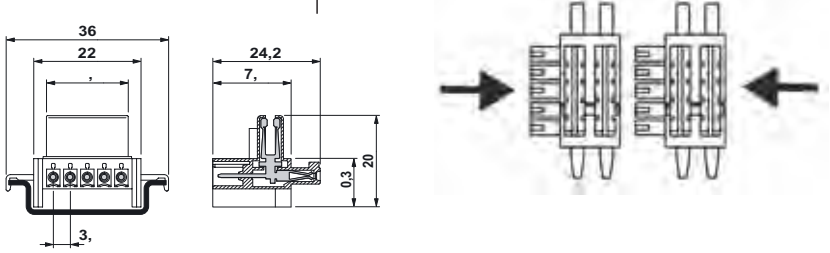
To 1% of final value: 0.260 sec; (0.065 sec @ 16 Hz) (0.008 sec @ 125 Hz)
To 0.1% of final value: 0.330 sec; (0.083 sec @ 16 Hz) (0.010 sec @ 125 Hz)
To 0.02% of final value: 0.390 sec; (0.095 sec @ 16 Hz) (0.012 sec @ 125 Hz)

Dimensions

Dimensional drawing



Housing height [A] : 114.5 mm
Housing depth [B] : 99 mm
Housing width [C] : 22.5 mm



DIN Power Connection (top)

5	N/C
4	N/C
3	N/C
2	POWER COMMON
1	DC POWER

Optional DIN Power Rail Connector Model 5M-PCON

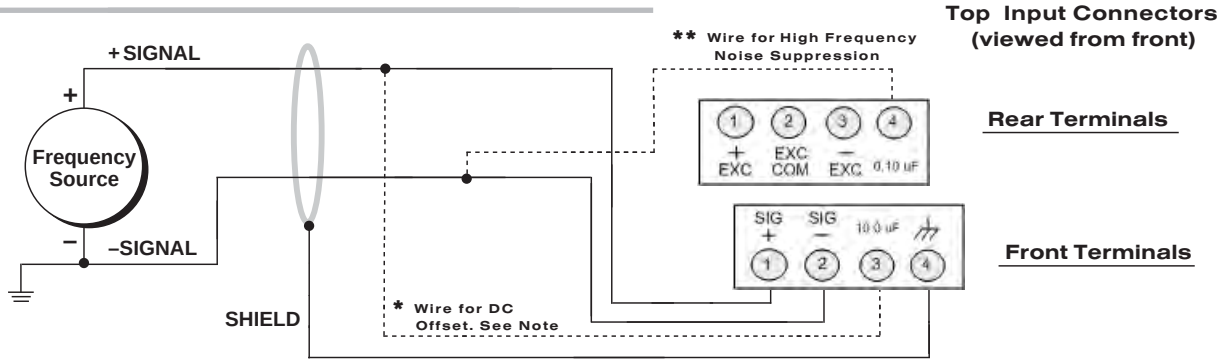
2 TRANSDUCER CONNECTIONS

The Model 5M40 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 twisted pair - wired as indicated (Fig. 1).
Table 1 denotes screw terminal assignments

Table 1 Model 5M40 Pin Assignments

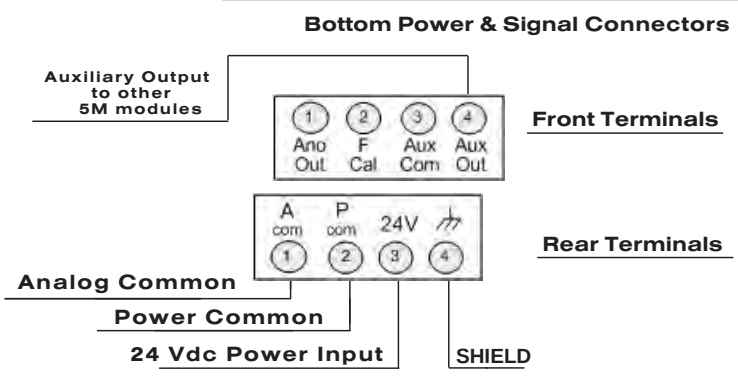
I/O Connector Pin Number	Screw Terminal	Terminal Label	Conditioner Line Function
Top Rear 1	1	+ EXC	+ EXCITATION
Top Rear 2	2	EXC COM	EXCITATION Common
Top Rear 3	3	- EXC	- EXCITATION
Top Rear 4	4	0.10 uF	HF Noise Suppression Cap
Top Front 1	1	+ SIG	+ SIGNAL Input
Top Front 2	2	- SIG	–SIGNAL Input
Top Front 3	3	10.0 uF	DC Offset Cap
Top Front 4	4	⏚	SHIELD
Bottom Front 1	1	Ano Out	ANALOG Output
Bottom Front 2	2	F Cal	Reference Calibration
Bottom Front 3	3	Aux Com	Auxiliary Common
Bottom Front 4	4	Aux Out	Auxiliary Output
Bottom Rear 1	1	A Com	Analog Common
Bottom Rear 2	2	P Com	Power Common
Bottom Rear 3	3	24 V	24 Vdc Power
Bottom Rear 4	4	⏚	SHIELD

Fig. 1 Model 5M40 Transducer Cabling - Frequency



*** DC Offset elimination**
Wire + Signal directly to 10.0 uF terminal.
Do not connect to + Signal terminal.

**** High Frequency Noise Suppression**
Wire 0.10 uF terminal to - Signal.
Maintain - Signal terminal connection
Use this connection for magnetic pickups.



2 TRANSDUCER CONNECTIONS

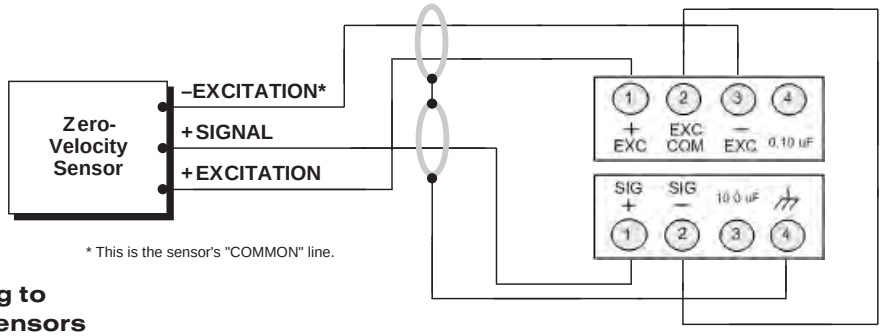


Fig. 1(a) Cabling to Zero-Velocity Sensors

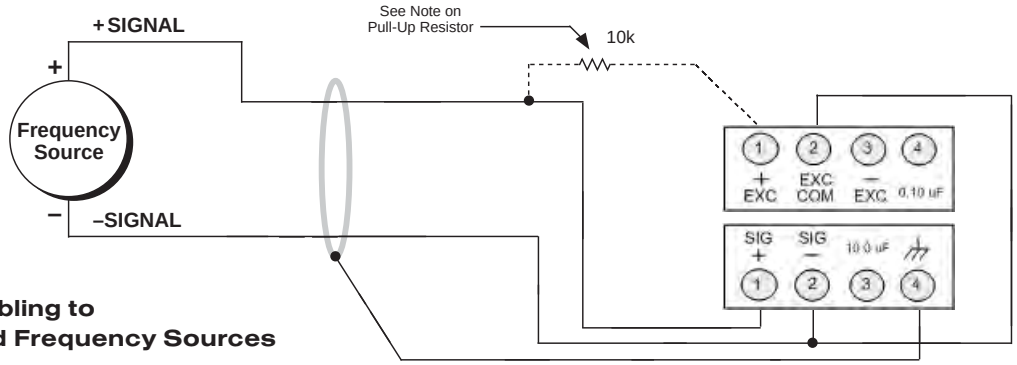


Fig. 1(b) Cabling to Ungrounded Frequency Sources

ELIMINATION OF DC OFFSET (10-µF)

The 5M40 is supplied with two *capacitive-coupled terminal inputs,* 0.1- and 10-microFarad capacitance. These special inputs may be used with either floating or grounded configurations; they would not normally be used with zero-velocity sensors requiring 10-V excitation. The larger (10-µF) capacitive coupling can be used to eliminate any positive or negative DC offset that exists for a 5M40 input frequency signal. Simply connect the +SIGNAL line from the frequency source to the 10-µF terminal instead of to the normal +SIGNAL terminal. The capacitor is here in series with the +SIGNAL input and allows only AC to pass.

SUPPRESSION OF HIGH-FREQUENCY NOISE IN LOW-FREQUENCY INPUT (0.1-µF)

False triggering can sometimes occur, especially at the *low-frequency input range*, because of stray pickup of frequencies outside the common-mode range. Capacitive coupling of the frequency input to ground can in such cases serve to suppress unwanted signal noise. *This noise suppression is always recommended when using a MAGNETIC PICKUP as the frequency source.* Thus, if you find your frequency reading to be unacceptably unstable or "noisy," you should tie the 0.1-µF pin to –SIGNAL while maintaining the normal +SIGNAL connection.

PULL-UP RESISTOR

When used with an *open-collector* type sensor, the 5M40 requires a pull-up resistor (typically *10 k*Ω) between the +SIGNAL and the +5 V-DC EXCITATION terminals.

3 CALIBRATION

Internal Frequency Reference

The instrument can be placed in the calibration mode by shorting "F Cal" and "Power Common" terminals. This will activate an internal frequency standard which is controlled by the Range switch settings selected. This feature is used to verify operation and to provide a convenient Span reference for the 5M40.

CALIBRATION

This section contains the instructions for calibrating the 5M40. Included is a functional description of the instrument front-panel (see Figure 2). 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. Set the Coarse Span arrow to the "<" position as indicated on the front label.

(b) Set the Frequency Range switches per Table 2 for the span frequency window indicated.

(c) Set the Filter switches, as recommended, per Frequency Range selected in step (b). Refer to Tabel 4. With zero frequency applied, adjust the Fine Zero for 0 Vdc (or 4mA for current mode).

(d) If using a known frequency source or reference standard, apply the full scale frequncy input. Adjust Coarse Span until the nominal full scale voltage or current is present on the analog output line (i.e. 10 Vdc or 20mA). Adjust the Fine Span control for the proper precision expected on the analog output signal. Recheck Zero and Span.

(e) If using the internal reference provided by the 5M40, jumper "F Cal" to "Power Common". This replaces the external signal with an internal reference which is 80% of the chosen range as established in Table 2. (i.e. 250 Hz, 4kHz, 32kHz). Adjust the Fine Span control to set the output to 80% of the Mode selected (i.e. 4 Vdc for 5 Vdc Mode, 16.8 ma for current mode). Recheck Zero and Span.

(f) If it is desired to set full scale (5, 10 Vdc or 20mA) to any other value of frequency, using the FCal reference, first Zero the output then refer to one of the formulas below to calculate the output reading. If the calculated value does not lie between 55% and 115% of full scale, choose a higher or lower frequency range as appropriate. Adjust the Coarse and Fine Span controls to the calculated value. Recheck Zero and Span.

3 CALIBRATION *(cont.)*

Internal Frequency Reference with **5 Vdc output Full Scale**

4.000 Volts x Frequency Range Chosen * / Desired Frequency for 5 Volts Output

Internal Frequency Reference with 10 Vdc output Full Scale

8.00 Volts X Frequency Range Chosen * / Desired Frequency for 10 Volts Output

Internal Frequency Reference with 20 mA output Full Scale

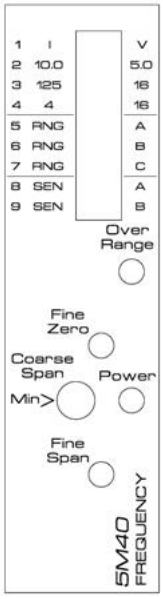
4.0 mA + 16.8 mA x Frequency Range Chosen */ Desired Frequency for 20 mA Ouput

* Frequency Range Chosen: This is the value as selected by the Range A, B and C switches on the front panel (i.e. 250Hz, 500Hz, 1kHz .....)

(g) With the transducer signal source connected and producing approximately one half of full scale, choose a sensitivity setting that gives a stable reading. Refer to Table 3.

Note: Choosing a filter setting that is lower than Table 2 recommends will allow a wider measurment range (lower frequency with stable readings) at the cost of response speed. Choosing a filter setting that is higher than Table 2 recommends will allow a faster response at the cost of a narrower measurment range of stable reading.

3 CALIBRATION (cont.)



Switch 1 - Mode - selects current (4-20mA) or voltage analog output
Switch 2 - Volts - selects +/- 5 or +/- 10 Vdc when mode is voltage
Switch 3 - Filter - selects 125 Hz or 16 Hz at 3 dB, for 16 Hz switch 4 must be set to the right
Switch 4 - Filter - selects 4 Hz or 16 Hz at 3 dB, for 16 Hz switch 3 must be set to the right
Switch 5 - Range A - selects input frequency range, see table 1
Switch 6 - Range B - selects input frequency range, see table 1
Switch 7 - Range C - selects input frequency range, see table 1
Switch 8 - Sensitivity A - selects input trigger level, see table 2
Switch 9 - Sensitivity B - selects input trigger level, see table 2

Fine Zero - 18 turn potentiometer for fine zero balance control

Coarse Span - 16 position switch adjustment for stepped gain control
Fine Span - 18 turn potentiometer for fine gain - span control

Over Range - indicates when the analog output is 2% greater than mode selected
Power - indicates the power input votlage is ON

Fig. 2 Front Panel Settings and Indicators

Range Switch Settings

	C (7)	B (6)	A (5)
250 Hz	←	←	←
500 Hz	←	←	→
1 kHz	←	→	←
2 kHz	←	→	→
4 kHz	→	←	←
8 kHz	→	←	→
16 kHz	→	→	←
32 kHz	→	→	→

Coarse Span Adjustment Window

200 - 350 Hz
300 - 700 Hz
700 - 1400 Hz
1400 - 2800 Hz
2800 - 5600 Hz
5600 - 11000 Hz
11000 - 22000 Hz
22000 - 40000 Hz

Recommended Filter Setting

Fil (4)	Fil (3)
←	→
←	→
←	→
→	→
→	→
→	→
→	←
→	←

Table 2- Switch 7 - 6 - 5

Sensitivity Switch Settings

	B (9)	A (8)
0.05 - 2.0 V	←	←
0.25 - 10.0 V	←	→
1.0 - 40.0 V	→	←
5.0 - 250.0 V	→	→

Table 3 - Switch 9 - 8

← Denotes switch is in the left position
→ Denotes switch is in the right position

When viewed from the front of the 5M40

Filter @ 3dB	Lowest Frequency See Note	Fil (4)	Fil (3)
4 Hz	20	←	→
16 Hz	80	→	→
125 Hz	640	→	←

Note: Lowest Frequency measured for < 1 mV RMS ripple

Table 4 - Switch 4 - 3

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