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INTRODUCTION

The *DEFT-1*/*DEFT-2 TACHOMETER* precisely and rapidly converts a quadrature signal from an optical encoder to an accurate, noise free analog output signal for control or monitoring use. The unit will detect direction of motion and will convert the input frequency signal (DC to 250 kHz) to industry standard)10 volt DC or 4-20 mA analog outputs.

Advanced technology, innovative design of the receiver section and use of a sophisticated quadrature signal filter allow the *DEFT-1*/*DEFT-2 TACHOMETER* to be placed at long distances from the encoder while maintaining excellent noise immunity in a harsh industrial environment. The use of a highly integrated frequency to voltage conversion stage followed by a proprietary adaptive filter provides a very fast response time (<15 ms) while keeping the low output ripple at an absolute minimum (<20 mV @ 1 Hz, <3 mV @ 300 Hz).

High precision components are used throughout the *DEFT-1*/*DEFT-2 TACHOMETER* to insure a highly linear output with excellent temperature stability over the extended industrial range (-25°C to 85°C).

The DEFT-1 TACHOMETER is a permanently mounted field unit built to user specifications. The DEFT-2 TACHOMETER is a free standing unit that allows the user to prescale the input signal (using one of 6 selectable ratios) and change the relative direction of travel.

DESCRIPTION

The *DEFT-1/DEFT-2 TACHOMETER* system is composed of two parts: an optical encoder (provided by others) and a tachometer module.

Optical Encoders: Transmit two square wave signals whose frequency is proportional to their shaft rotational velocity. The two signals are in quadrature (out of phase by 90°). The quadrature enables digital filtering of the input signal and detection of the direction of rotation. The encoders should be equipped with line driver outputs and 5 VDC power. Encoders with 2000 PPR are recommended for maximum performance.

NOTE: The proper coupling and precise alignment of the encoder shaft is extremely important. The encoder output will be effected if proper care is not taken.

Tachometer Modules: Convert the square wave signals to a) 10 VDC or 4-20 mA output signal. The modules include digital filtering that allows the encoders to be located up to 3000 feet away from the modules.

The tachometer modules are powered by 120 VAC or optional 24 VDC and 220 VAC voltages. It should be noted that the DC modules are not protected against reverse polarity and can be damaged by reverse wiring. The encoders are powered by an isolated power supply included in the tachometer modules, when this option is ordered.

The *DEFT-1/DEFT-2 TACHOMETER* can be equipped with up to four relays.

A. Direction of Motion

B. Zero Speed
The zero speed relay is normally open when the shaft is not turning.

C. Additional Relays
Two additional relay outputs are available for overspeed or underspeed detection. The relays can be Normally Open or Normally Closed and all thresholds are adjustable.

SPECIFICATIONS

GENERAL

Temperature Range	-25 to +85°C
Enclosure	
DEFT1	Foot Mounted General Purpose Aluminum
DEFT2	Free Standing Electronic Instrument
Connectors, Inputs	
DEFT1	Phoenix® Quick Connectors
DEFT2	Amphenol® MS3012A-16S-1P (7 pin male)
Connectors, Outputs	
DEFT1	Phoenix® Quick Connectors
DEFT2	RCA

DISTANCE TO ENCODER w/LINE DRIVER OUTPUT (8830 or EQUAL)

At 50 kHz	3000 feet max.
At 250 kHz	1000 feet max.

POWER

Standard Power	110 VAC (30 mA) Switched IEC-320 Receptacle
Optional Power	24 VDC (200 mA) 220 VAC (30 mA)
Isolated Encoder Power	5 VDC at 200 mA

INPUT SIGNAL

Type	Quadrature
Max. Frequency	
DEFT1	Fixed frequency 1 - 250 kHz with ± 15% adjustment.
DEFT2	1 - 64 kHz with prescaling - normal range 4 - 8 kHz
Input Impedance	2kΩ
Sensitivity	1 volt
Max. Differential Voltage	30 volt
Isolation	1500 volt (requires Isolated Encoder Power)

SIGNAL PRESCALE

Method Used	
DEFT1	Internal Jumpers
DEFT2	External Switches
Range	x4, x2, x1, '2, '4, '8
Direction of Motion	
DEFT1	Forward/Reverse (Jumpers)
DEFT 2	Forward/Reverse (Switch) and Indicator

ANALOG OUTPUTS

Standard output	0-10 volt Unipolar into 5 kΩ
Optional outputs	±10 volt Bipolar into 5 kΩ
	4-20 mA Unipolar into 500 Ω
	4-20 mA Bipolar into 500 Ω
Response Time (0-90% fs)	10 ms (>8 kHz), 15 ms (<8 kHz)
Output Ripple	<20 mV at 1 Hz, <3 mV above 300 Hz
Non-Linearity	0.005% of Full Scale Typical
Temperature Drift	0.01% per °C Typical
DEFT1	±15% of Full Scale
DEFT2	±35% of Full Scale

DIGITAL OUTPUTS (OPTIONAL)

Direction of Motion Relay	
Over Speed Relay	0-100% Full Scale
Under Speed Relay	0-100% Full Scale
Relay Specifications	SPDT, 2 amp DC, 0.6 amp AC

WIRING INSTRUCTIONS

1. The wiring diagram for the tachometers is provided in Fig 1.

2. The encoder power is isolated from the input power and should be left floating with respect to the system ground. Do not connect the encoder power negative terminal to the system ground or to the 24 VDC negative line.

3. The encoder shield should be connected on the encoder side only. The 4-20 mA shield should be connected on the tachometer side only.

4. The tachometers are normally calibrated for a full scale output of) 10 VDC or 20 mA at 133% of full speed. This is done to allow overspeed detection. If required, the tachometers full scale can be changed. The maximum adjustment for the DEFT1 is) 15% of full speed, and the DEFT2 is)35%.

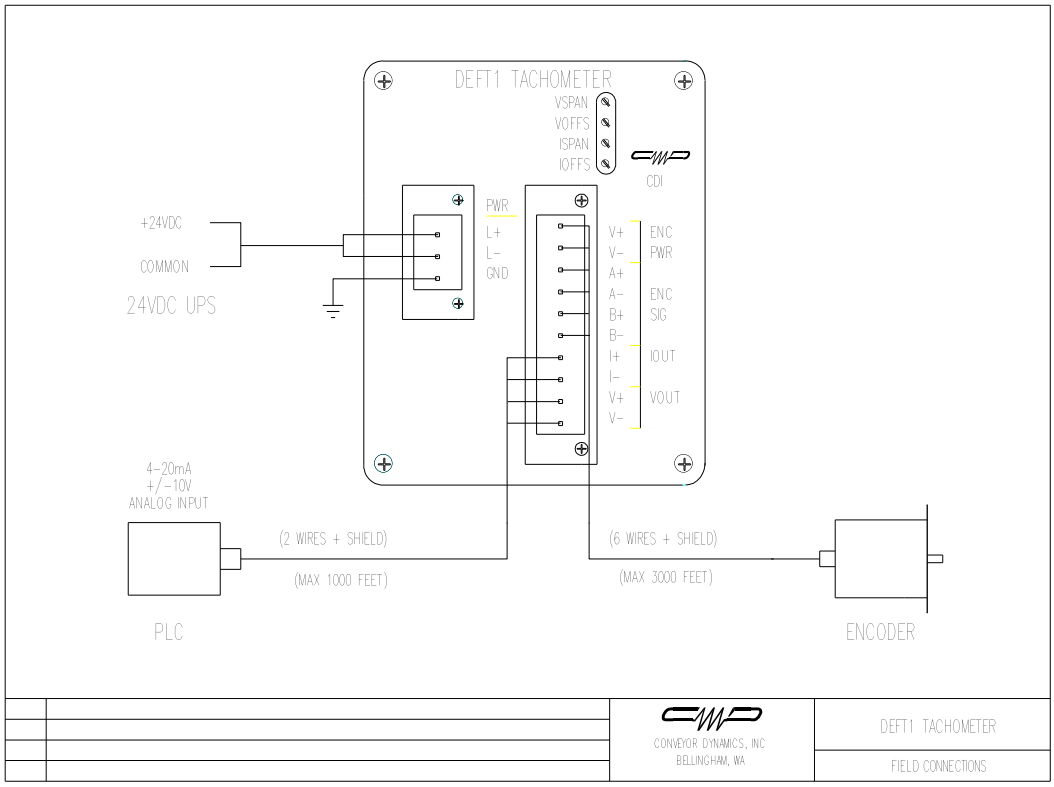

Fig. 1: Tachometer Wiring Diagram

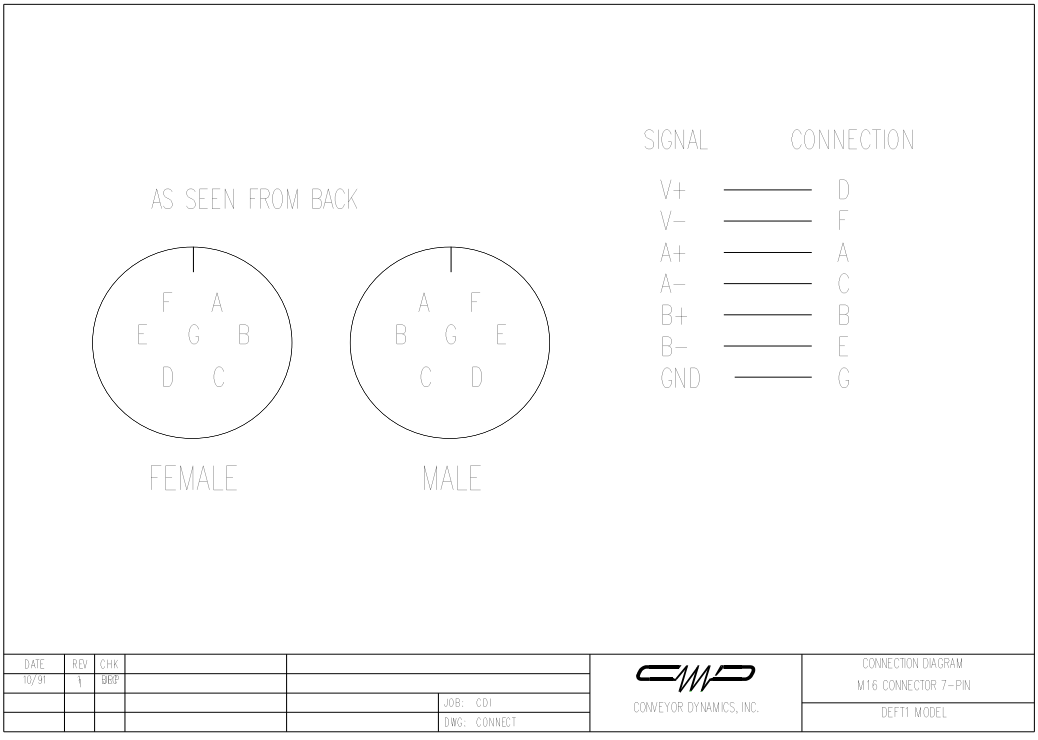

Fig. 2. M16 7-Pin Connector Wiring Diagram

ADJUSTMENTS & DIAGNOSTICS

1. Basic Adjustments

   With the shaft stopped, turn the IOFFs potentiometer to read O VDC or 4 mA at the tachometer output signal.

   Start the shaft and run it at full speed (100%). Turn the VSPAN potentiometer to read 7.50 VDC or 16 mA at the tachometer output signal.

   NOTE: The ISPAN adjustment is for fine adjustments only (+/- 1%) and should not be used.

2. Basic Diagnostics/without Calibrator

   If the tachometer module output falls outside the 4-20 mA range, this usually indicates a failure of the 24 VDC power or a failure of the tachometer module.

   If the tachometer module output is within the 4-20 mA range but is not accurate, this usually indicates a failure of the encoder or an encoder wiring fault.

3. Basic Diagnostics with Calibrator

   A tachometer calibrator is available to assist with diagnostics. When using the calibrator, first disconnect the M16 plug from the optical encoders and plug it into the simulator. Adjust the simulator for the highest preset frequency lower than the full range frequency (i.e., on a 3.1 kHz tachometer, adjust the simulator to 2 kHz). If the tachometer output is correct, this indicates a failed encoder.

   Next, reconnect the encoder and disconnect the wiring harness from the tachometer module (Phoenix connector on DEFT1, M16 plug on DEFT2). Connect the simulator directly to the tachometer module using the adapter provided. Set the simulator frequency as above and check the tachometer output. If the tachometer output is correct, this indicates a problem with the field wiring between the optical encoder and the tachometer module.

   If the output signal is not correct, then check the input power. If the power is on, the tachometer is faulty.

4. Tachometer Repair

   Faulty tachometers can be returned to CDI for diagnostics and repair. Please indicate what the symptoms were when the tachometer was replaced. Return address for Conveyor Dynamics, Inc:

   Control Dynamics
   1111 West Holly
   Suite A
   Bellingham, WA 98225