

# 3500 INSTRUMENT SERIES



Carrying on Daytronic's long tradition of rock-solid analog signal conditioning, the 3500 Series offers high-speed COMPUTER/ NETWORK COMMUNICATIONS in a low-cost, DIN-packaged industrial data acquisition and control instrument.

### Superior Signal Conditioning

Each single-channel 3500 Series instrument provides 16-bit, 1-kHz A/D conversion with transparent auto-calibration every 2 seconds. To ensure noise-free indication and control action, both analog and digital *filtering* levels are user-selectable from the front panel.

A number of calibration techniques are available, including "absolute," "actual" or "simulated" two-point ("deadweight"), and "calculated." The best calibration method to employ will depend both on the conditioner model and on known characteristics of the measured test or process.

(cont'd)

**Table 35.1**  
**Model-Numbering System for the 3500 Series**

## Model 35XX

"35" is the series identifier, used with all units

Third and Fourth digits identify "type" of signal source:

- 30 = [LVDT](#)
- 40 = [Frequency Source](#)
- 60 = [Analog Voltage Source](#)
- 70 = [Strain Gage Transducer \(DC-excited\)](#)
- 78 = [Strain Gage Transducer \(AC-excited\)](#)

- ✳ = Standard feature for ALL models
- ★ = Standard feature for SOME models

See [General Specifications](#).

- ✳ ANALOG SIGNAL CONDITIONING WITH MULTIPOLE LOW-PASS ACTIVE FILTERING AND REGULATED, REMOTELY SENSED EXCITATION
- ✳ SELECTABLE ANALOG FILTERING
- ✳ SELECTABLE DIGITAL FILTERING
- ✳ INTERNAL LINEARIZATION
- ✳ 5-DIGIT LCD DIGITAL INDICATION
- ✳ DUAL LIMIT MONITORING WITH FRONT-PANEL ANNUNCIATION AND ISOLATED LOGIC CONTROL OUTPUTS
- ✳ PROGRAMMABLE LIMIT HYSTERESIS
- ✳ SCALABLE "LIVE" ANALOG OUTPUT
- ★ REAL-TIME ANALOG POSITIVE PEAK CAPTURE
- ✳ DIGITAL TRACK AND HOLD
- ✳ AUTOMATIC TARE OFFSET
- ✳ FORMATTABLE SERIAL-ASCII DATA TRANSMISSIONS
- ✳ RS232 (SINGLE-NODE) DATA COMMUNICATIONS WITH OPTIONAL IEEE-488 OR RS422 CONVERSION
- ✳ RS485 (NETWORK) DATA COMMUNICATIONS
- ✳ AUTOMATIC PRINT INTERVAL
- ✳ INSTRUMENT SETUP VIA FRONT PANEL OR EXTERNAL COMPUTER/TERMINAL
- ✳ CONFIGURATION SECURITY VIA CODE-NUMBER ENTRY
- ✳ FREE SOFTWARE AVAILABLE FOR NETWORK MANAGEMENT, DATA DISPLAY AND COMMUNICATIONS, AND OTHER UTILITIES
- ✳ LOGIC-INPUT CONTROL OF PEAK CAPTURE, TARE OFFSET, HARD-COPY PRINTOUT, AND UNLATCHING OF LATCHED CONDITIONS

Nonlinear inputs can be calibrated using internal 15-segment linearization. Linearization points can be either numerically entered or "forced" to desired output values.

For batch weighing and other applications that require *auto-taring*, an appropriate offset value can be automatically applied at the touch of a button, by external command, or on receipt of a logic-level input at the rear of the unit (see [Fig. 35.12\(e\)](#)).

Both "live" data and user-entered setup values are vividly displayed by the front-panel reflective LCD. Typical measurement accuracies vary with different models (see individual instrument specifications).

There are 3500 instruments dedicated to



[5- or 7-wire AC-excited LVDT's](#) or [3- or 5-wire AC-excited variable reluctance transducers](#)



[frequency-generating transducers](#) (including [magnetic pickups](#) and [turbine flowmeters](#))



[2-wire DC voltage sources](#), [floating or grounded](#)



[DC-excited strain gage transducers](#) ([load cells](#), [pressure sensors](#), etc.)



[AC-excited strain gage transducers](#) ([rotary transformer torque sensors](#), etc.)

### Limit Monitoring and Local Real-Time Control

Measured data is continuously evaluated with respect to three user-defined limit zones (HIGH, OK, and LOW). Real-time limit status is indicated by front-panel LCD annunciators, while a corresponding TTL/CMOS-level control output is issued from the rear LOGIC I/O CONNECTOR (see [Fig. 35.6](#)).

Each logic output is isolated to  $\pm 1500$  V and provides up to 50 mA for driving external devices directly. You can set the HIGH LIMIT and LOW LIMIT outputs to be either latching or nonlatching, as required by your application. For any non-latching limit, you can define a hysteresis window to prevent toggling of the limit output from signal noise.

A user-scalable  $\pm 5$ -V analog output is generated for connection to a strip-chart recorder or other device.

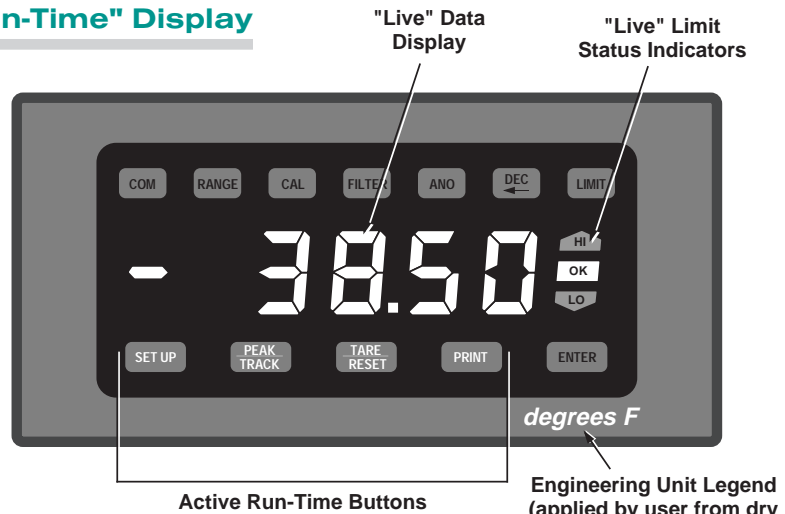
The analog output can also be used as feedback for a PID control loop. See [General Specifications](#) for full output characteristics.

### Peak Capture and Track/Hold Operation

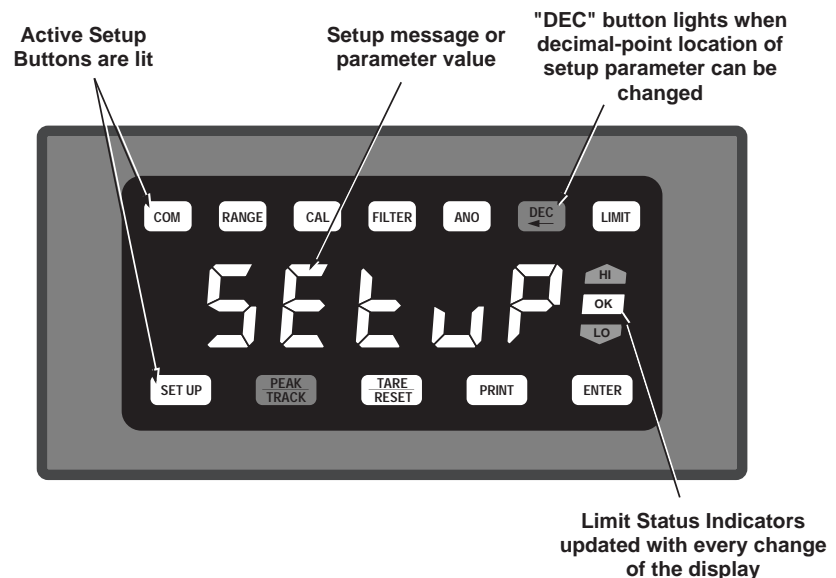
The Model 3540 Frequency Input Conditioner employs a digital technique for capturing the most positive measurement reading since the instrument was last reset.

*For all other 3500 Series models, peak capture is a purely analog*  
(cont'd)

**Fig. 35.1(a)**  
**Typical 3500 Series "Run-Time" Display**



**Fig. 35.1(b)**  
**Typical 3500 Series "Setup" Display**



function, the last-captured positive maximum being *digitally held* until a higher input-signal value is perceived or the instrument is reset.

Any 3500 instrument can be placed in TRACK/HOLD mode (instead of PEAK CAPTURE). When this is the case, the instrument can be commanded to freeze the present value of the analog input signal, without decay, until a command is received to return to normal "TRACK" operation. See, for example, the brake testing application in Fig. 35.12(b).

Both PEAK CAPTURE and TRACK/HOLD modes may be controlled by front-panel buttons, by a rear-panel logic input, or by mnemonic com-

mands received at the instrument's [RS232/RS485 Interface Port](#).

#### Front-Panel or Remote Setup

All 3500 instruments can be completely set up and operated either through the front-panel keypad or through simple English mnemonic commands received from an external computer or terminal through the [RS232/RS485 Interface Port](#).\*

Entry of a unique configuration security code, if desired, prevents an operator from modifying the

existing setup via the front panel. All setup values are automatically stored in nonvolatile memory, for complete poweroff protection.

In addition to its network setup and configuration "cloning" functions, Daytronic's [StartPAC 100](#) software includes a simple terminal emulation program that lets you issue any standard 3500 Series commands from a remote PC.

Fig. 35.3  
Legend Sheet

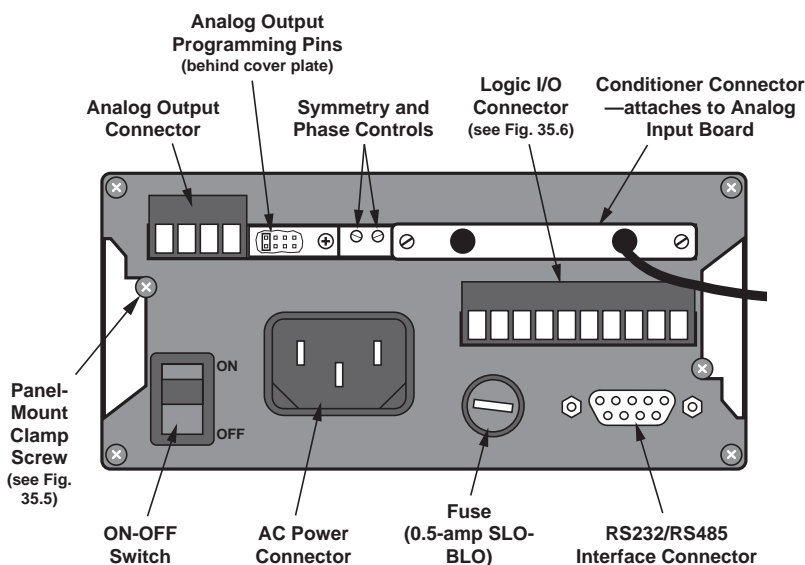
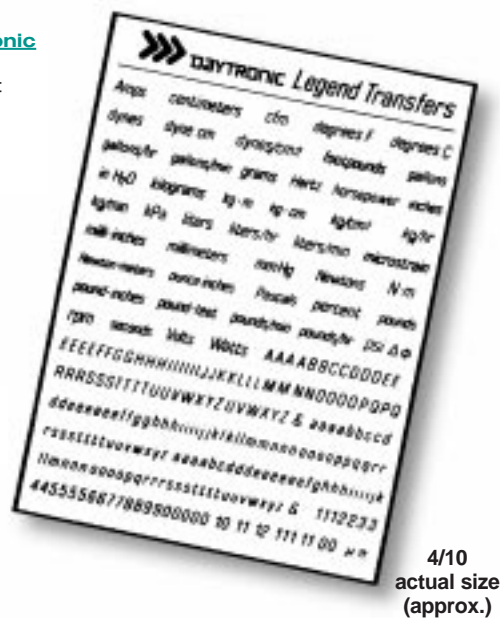
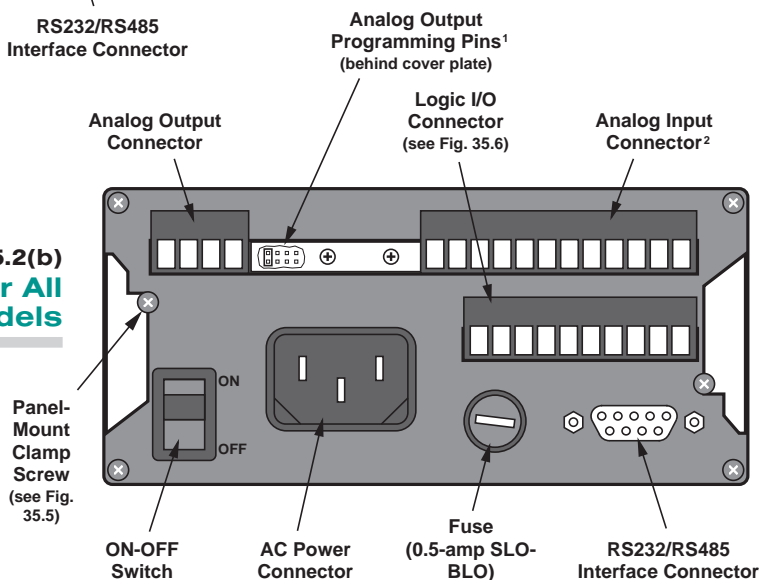


Fig. 35.2(a)  
Rear Panel for  
the Model 3578

Fig. 35.2(b)  
Rear Panel for All  
Other 3500 Models



<sup>1</sup> Not present on the **Model 3540 Frequency Input Conditioner**.

<sup>2</sup> The number of analog-input screw terminals will vary with different instrument models.

### Daytronic Corporation

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## 3500 SERIES GENERAL SPECIFICATIONS

### Physical / Environmental

**Case:** DIN package outline of extruded metal, with splash-resistant front panel (for instrument dimensions, see Fig. 35.4, below); secure rear connections via screw terminals\*; clamp slides allow mounting in user's precut panel (see Fig. 35.5, below—maximum panel thickness allowed is 0.24 inch (6 mm))

**ESD Immunity:** Meets Class 3 Industrial Standard (8 kV) everywhere on the case and on every line

**Operating Temperature Range:** 0° C to +50° C (+32° F to +122° F)

**Storage Temperature Range:** -40° C to +80° C (-40° F to +176° F)

**Operating Humidity Range:** 10 to 95% max., noncondensing

**Instrument Weight:** 3.25 lb (1.47 kg), approximate

### Power

**Voltage:** 90-265 V-AC (eliminates the need to convert between 110-V and 220-V levels)

**Frequency:** 50-400 Hz

**Consumption:** 10 W max.

### Display

5-digit LCD reflective, non-light-emitting

### Signal Conditioning (All Models)\*\*

**A/D Conversion:** 16-bit; approximately 1-kHz conversion rate; transparent autocalibration every 2 seconds

**Analog Filtering:** See individual model specifications

**Digital Filtering:** Quieting factor selectable from front panel or by computer-port command

**Internal 15-Segment Linearization:** Programmable from front panel or by computer-port command

**Positive Peak Capture:** See individual model specifications

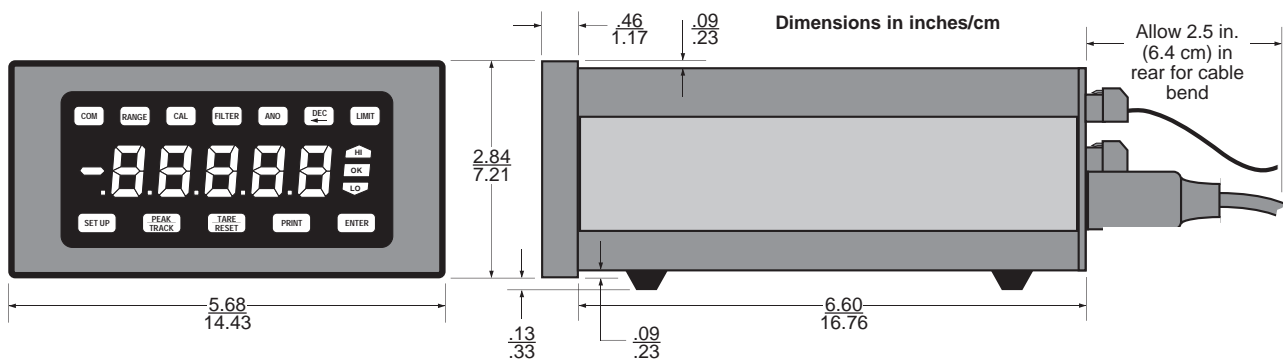
### Limit Logic

Three limit zones (LOW/OK/HIGH) with front-panel annunciation and corresponding TTL-level logic outputs (see **Logic I/O**); outputs for LOW and HIGH limit conditions can be latching or nonlatching; each limit setpoint has a user-settable hysteresis window to prevent toggling of the limit output from signal noise

### Logic I/O

TTL- and CMOS-compatible; isolated ( $\pm 1500$  V) from power and communication ports. Negative-true outputs for limit monitoring (isolated +5 V provides up to 50 mA for driving external devices directly); negative-

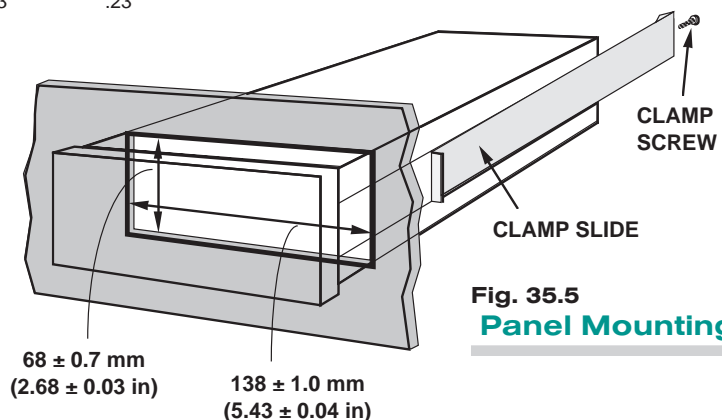
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**Fig. 35.4**  
**3500 Series Bench-Mount Dimensions**

\* Except for the **Model 3578 AC Strain Gage Conditioner**, which uses a special Conditioner Connector (shown in Fig. 35.2(a)) requiring direct solder-terminal attachment of cable leads.

\*\* See also the discussion of **ACCURACY Specifications for 3500 and 4000 Series Instruments**.



**Fig. 35.5**  
**Panel Mounting**

## 3500 SERIES GENERAL SPECIFICATIONS (cont'd)

true *inputs* for control of PRINT, TARE, PEAK, and UNLATCH functions (see Fig. 35.6)

### Logic Inputs\*:

Logic Level	Volts (Operating)	Without Instrument Damage
0	0.9 V (max.)	-0.5 V (min.)
1	2.5 V (min.)	5.5 V (max.)

### Logic Outputs:

Logic Level	Voltage at Current
0	0.45 V (max.) @ 10 mA (sink)
1	2.6 V (min.) @ 0.5 mA (source)

## Analog Output

**Full-Scale Range:**  $\pm 5$  V nominal;  $\pm 8$  V maximum

Range is scalable in 0.1% increments between 74.5% and 125.5% of nominal input. *Except for the Model 3540, may be sourced by conditioned input*

- (A) after the FIXED ANALOG FILTER (see individual model specifications);
- (B) after PEAK CAPTURE; or
- (C) after the SELECTABLE ANALOG FILTER (see individual model specifications)

**Allowable Loading:** 5 mA, maximum

**Offset Range Adjustment:**  $\pm 25.5\%$  in 0.1% increments

**Offset Accuracy:** 0.1% maximum

**Span Accuracy:** 0.2% maximum

**Offset and Span Drift:**  $\pm 50$  ppm/ $^{\circ}$ C;  $\pm 20$  ppm/month

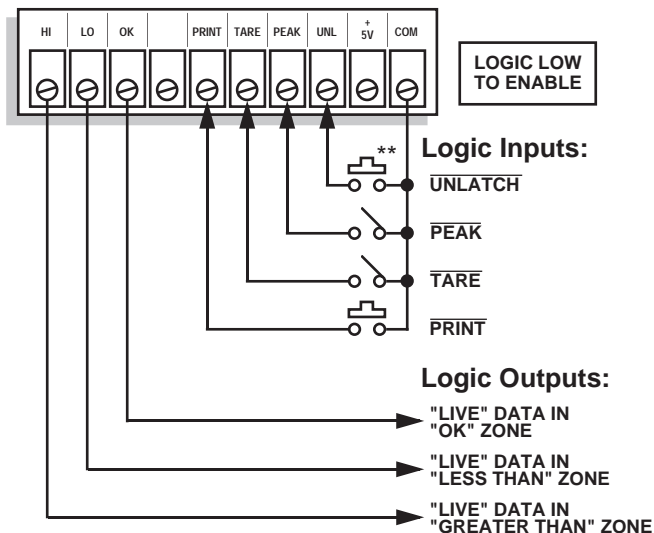
### Frequency Characteristics and Step-Response

**Settling Times:** These characteristics vary with the model number and selected analog output source point (A, B, or C); see individual model specifications

**Configuration:** Single-ended, return to System Common

**Fig. 35.6**

### Standard 3500 Series Logic I/O




## Communications

**Serial:** 9-pin RS232/RS485 port (interface mode selectable by instrument "node-number" setting); standard baud rates from 300 through 153.6K for both RS232 and RS485; RS485 configuration allows operation as an individual data-collection "node" within a computer-controlled network

**NOTE:** RS485 conversion is required at the computer's I/O port (see the [Models 5E485 and 5E25](#)); the RS232 output may be converted to RS422 standards by means of an optional [Model 10E422](#)

**Parallel:** IEEE-488 interface available as option, using the Daytronic [Model 10CIF488A Interface Adaptor](#)



**Custom Linearization**

To obtain accurate measurements from a *nonlinear* transducer signal may require the use of the 3500 instrument's internal "look-up" table.

By entering a zero point and up to 15 subsequent linearization points, you can easily define the ideal linear output for the measurement channel.

Go to a list of  
[Typical Customer-Specific  
 3500 Series Instrument  
 Modifications](#)

\* The minimum time allowed between activation and reactivation of any logic input is 100 ms.

\*\* Logic-input ground connections to be provided by the user.

# SINGLE- OR MULTINODE DATA COMMUNICATIONS

Each 3500 instrument's 9-pin **RS232/RS485 Interface Port** permits data interchanges of up to 153.6K baud. Current measurement data is transmitted from this port in response to an interrogation from an external computer or terminal, or in response to a PRINT command from a front-panel push button or logic-level input (see [Fig. 35.6](#)).

The user can format data transmissions by specifying a terminating character string, optional header and trailer strings, optional node-number "echo," and optional limit-status indication.

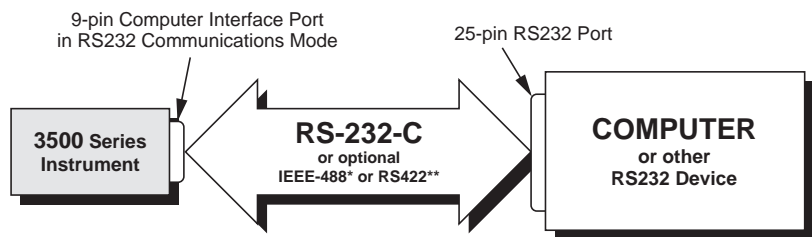
The Interface Port can be easily configured for either **single-node, full-handshake RS232 communications** or **multinode RS485 communications**.

## Single-Node (RS232) Communications

In *single-node* operation (Fig. 35.7(a)), the 3500 instrument connects to a supervisory computer that can control the unit directly via simple ASCII mnemonic commands\*—or to a printer, recorder, "dumb" terminal, or other RS232 device.

When the instrument is set for RS232 communications, you can specify the time interval that is to occur between successive automatic hard-copy transmissions (up to 68 minutes).

**Fig. 35.7(a)**  
**Single-Node RS232 Communications**



\* Requires [Model 10CIF488A](#) or equivalent.

\*\* Requires [Model 10E422](#) or equivalent.

Single-node **IEEE-488** or **RS422** communications are made possible by an optional interface adaptor ([Model 10CIF488A](#) or [Model 10E422](#), respectively, as described below).

## Multinode (RS485 Network) Communications

In *multinode* operation ([Fig. 35.7\(b\)](#)), the 3500 instrument can be a member of a high-speed multidrop network of up to 99 3500 Series and **4000 Series**\*\* data-collection instruments, mixed as desired. See [Fig. 35.11\(a\)](#) for an example of a plant-wide 3500 Series network.

Network interchanges take place over simple twisted-pair RS485 "daisy-chain" linkage, at standard baud rates from 300 through 153.6K.

In a multinode network like the one shown in [Fig. 35.7\(b\)](#), the host com-

puter can "open" any selected node by issuing an **OPEN (OPN)** command to the entire network. Only one node can be "open" at any one time. The currently "open" node (only) will respond to all subsequent commands issued to the network—including all requests for "local" measured and/or calculated data.

Simple polling routines let your computer optimize network transfer speed as it interrogates a sequence of nodes and receives appropriate response inputs. For computers with limited input buffering, the Daytronic [Model PC-HSICA High-Speed Interface Card](#) is available.

For easy configuration and monitoring of a multinode network, Daytronic's [StartPAC 100](#) software is available free of charge.

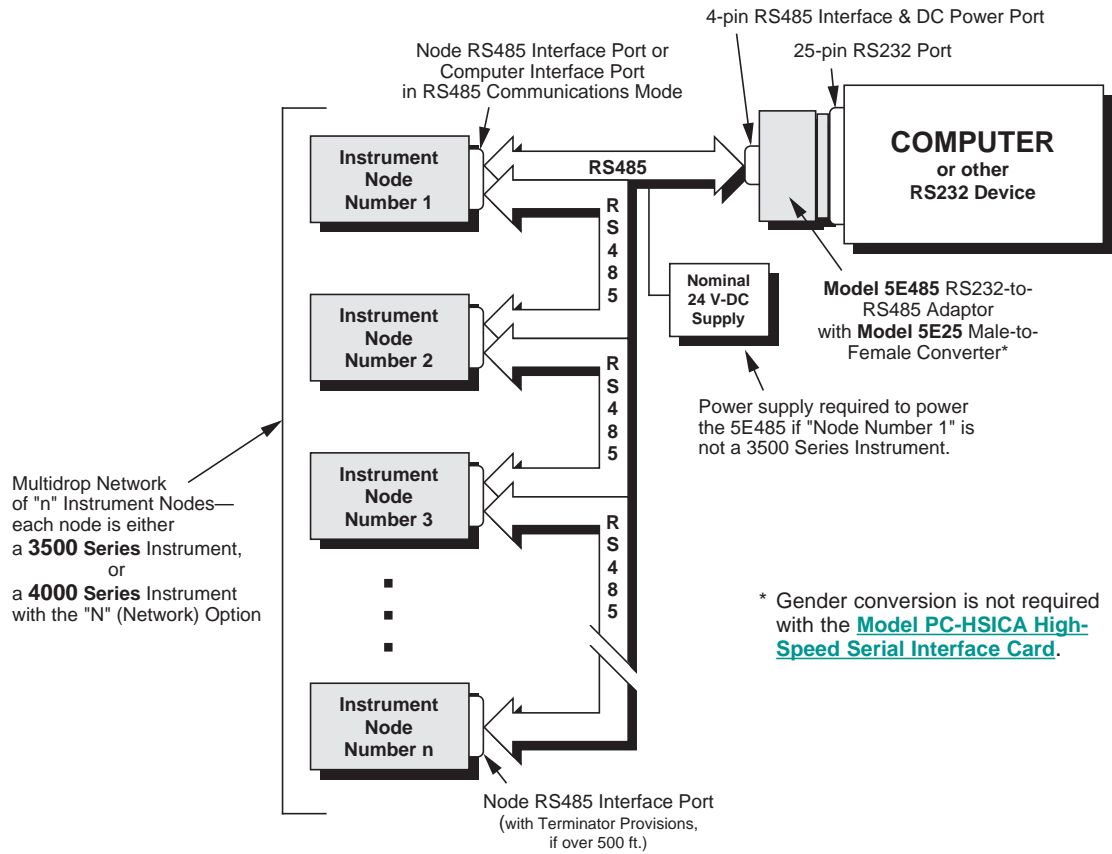
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\* See the [Summary of 3500 Mnemonic Commands](#) given at the end of the 3500 Series catalog section. The list includes both "setup" and "run-time" commands.

\*\* 4000 Series instruments with ["N" \(Network\) Option](#) only.

# SINGLE- OR MULTINODE DATA COMMUNICATIONS (cont'd)

**Fig. 35.7(b)**  
**Multinode RS485 Communications**



# ACCESSORIES FOR DATA COMMUNICATIONS

## Model 5E485 RS232-to-RS485 Adaptor and Model 5E25 Male-to-Female Converter

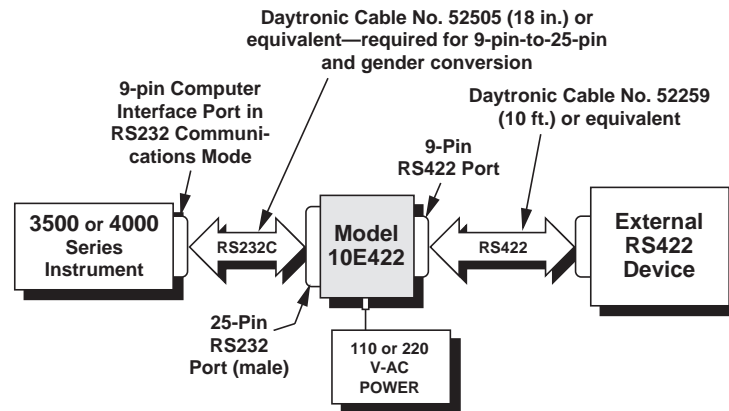
The 5E485 is a special connector assembly for interfacing a network of 3500 and/or 4000 Series instruments with an external computer, terminal, or other device with RS232 I/O capability.

The 5E485's 25-pin RS232 port attaches directly to the 25-pin RS232 port of the external device. Since the 5E485's RS232 connector is male, a Model 5E25 25-Pin Male-to-Female Converter is also normally required to permit physical connection of the 5E485 to the external device. If, however, the 5E485 is to be attached to the RS232 port provided by a [Model PC-HSICA High-Speed Serial Interface Card](#) installed in an external computer, the DB25 gender converter is not required.

[Fig. 35.7\(b\)](#) shows how the 5E485 and 5E25 are used to convert an instrument network's standard RS485 interface levels to RS232. The 5E485's 4-pin RS485 Interface & DC Power Port connects directly to the first network node instrument. In many cases, the network power supply (if required) will also be tied directly to this port.\* An external supply is required to power the 5E485, *unless the first network node is a 3500 Series instrument*, in which case the 3500 instrument's +12-V line may be used in place of an external supply.

\* The power source should be 10 to 40 V-DC (nominal 24 V-DC is recommended).

**Fig. 35.8(a)**  
**Model 10E422 Connections**



## Model 10E422 RS232-to-RS422 Converter

This external adaptor lets you convert a 3500 or 4000 instrument's computer interface port to RS422 standards, when that port is set for [single-node \(RS232\) communications](#).

[Fig. 35.8\(a\)](#) shows how the 10E422 is used to link a 3500 or 4000 instrument to an external device with RS422 I/O capability. Baud rate and other protocols for the resulting RS422 interface are identical to those to which the instrument's RS232 port has been set.

A special Daytronic cable (No. **52505**) must be ordered with the 10E422 when it is to be used with a 3500 or 4000 instrument. This cable makes the required pin-number and gender conversions.

A six-foot power cord is supplied with every 10E422, with a switch-selectable transformer that may be plugged into any standard source of 110 or 220 V-AC (60 Hz).

## Model 10CIF488A IEEE Interface Adaptor

The Model 10CIF488A enables any 3500 or 4000 instrument to be established as a "Talker/Listener" peripheral on a standard IEEE-488 bus, with a switch-selectable bus address from 0 through 30.

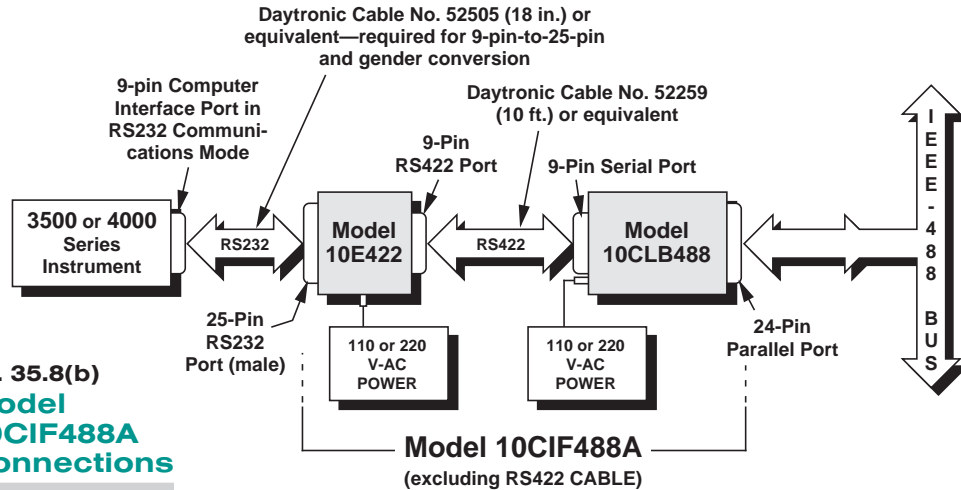
As shown in [Fig. 35.8\(b\)](#), the 10CIF488A consists of two separate units: the **Model 10E422 RS232-to-RS422 Converter** (described above) and the **Model 10CLB488 IEEE-to-RS422 Interface Converter**. The interconnecting RS422 cable must be supplied by the user (Daytronic Cable No. **52259** may be used for distances of up to 10 feet).

A special Daytronic cable (No. **52505**) must be ordered with the 10CIF488A when it is to be used with a 3500 or 4000 instrument. This cable makes the required pin-number and gender conversions between the 10E422 and the instrument's computer interface port, when that port is set for RS232 communications.

(cont'd)



# ACCESSORIES FOR DATA COMMUNICATIONS (cont'd)



**Fig. 35.8(b)**  
**Model 10CIF488A Connections**

Two six-foot power cords are supplied with every 10CIF488A, one for the 10E422 and one for the 10CLB488. Each cord has a switch-selectable transformer that may be plugged into any standard source of 110 or 220 V-AC (60 Hz).

### Model PC-HSICA High-Speed Serial Interface Card

This half-height card is recommended when an instrument or instrument network is connected to an external computer with limited input buffering. When installed in the computer, it makes available a DB25 RS232 port for asynchronous serial communication at 600, 1200, 2400, 4800, 9600, 19.2K, and 153.6K baud. Baud rate and other interface protocols may be completely specified via the DOS "MODE COM" or BASIC "OPEN COM" command, or through the Windows® TERMINAL program.

With enhanced EMI filtering and transient suppression, the PC-HSICA is recommended for serial interchanges not only because of speed, but also because it furnishes a *true hardware handshake*, thus reducing the possible noise effects that can result from the use of a long interface cable.

The PC-HSICA features receive and transmit FIFO's with 32-byte depth plus "Receive FIFO Full" and "Carriage Return Detect" interrupt capabilities. In addition, the card can be configured as a standard 16C650 UART with all its functional capability (requires optional driver).

# STARTPAC 100 SOFTWARE



Daytronic's **StartPAC 100** is a versatile menu-driven software package. It was designed primarily to provide easy configuration and monitoring of a data-collection network of up to 99 Daytronic instrument "nodes" (3500 Series and [4000 Series with "N" Option](#)). It can also be used, however, in a "single-node" environment—that is, when only a single 3500 or 4000 instrument communicates with a PC, as in [Fig. 35.7\(a\)](#).

The latest **StartPAC 100** version may be downloaded free of charge from [www.daytronic.com](http://www.daytronic.com). It's easy to use, and offers on-line HELP at every step.

Once each node instrument has been individually set up and all required network interconnections are in place, the software lets you

- set communications protocol values
- assign an instrument "name" to each node, either "manually" or "automatically"
- verify the network configuration by comparing node instrument assignments to actual attached nodes

- print the network configuration
- upload the setup configuration of the currently "open" node to a disk file—a "CLONING" function
- download a setup configuration stored in disk file to the currently "open" node (if it is of the appropriate type)—another "CLONING" function
- transmit to printer, screen, or disk file the setup configuration of the currently "open" node

In addition to its network setup and configuration "cloning" functions, **StartPAC 100** offers a number of other valuable utilities. It can emulate a simple ASCII "command and response" terminal, from which the operator may issue any valid command to any specific network node.\*

It can also display up to 100 data channels on user-formatted display pages.\*\* Displayed channels may be "mixed" from different network

\* Commands used to initiate standard data transmissions—such as **DUMP (DMP)**, **STREAM (STR)**, **HARD COPY (HCY)**, etc.—are exceptions. Such commands will be ignored. See the [Summary of 3500 Mnemonic Commands](#) given at the end of the 3500 Series catalog section. The list includes both "setup" and "run-time" commands.

\*\* The actual number of display pages you can have is limited only by your available hard-disk memory.

nodes. If desired, the software can be instructed to scan only one channel, at a rate that is "as fast as possible." Datalogging can also be initiated via **StartPAC 100**, and can take place automatically at a rate specified by the user (from "as fast as possible" to up to 24 hours).

**StartPAC 100** also contains programs for setting up and operating any [Model "4K/SPC" Statistical Process Control Instrument](#).



# MODEL 3530 LVDT CONDITIONER

The **Model 3530 LVDT Conditioner** accurately measures *displacement, force, pressure*, and other parameters obtained with a 5- or 7-wire LVDT sensor or with a 3- or 5-wire variable reluctance transducer. Input provisions exist for "long-stroke" LVDT's (see Specifications).

Working on the synchronous carrier-demodulator principle, the 3530 supplies nominal 3 V-AC (rms) excitation for a single transducer input. It then demodulates, filters, and amplifies the resulting signal to produce a reading precisely propor-

tional to LVDT core displacement. The 3530 automatically adjusts to the signal phase shift of the transducer in use, thereby insuring optimum sensitivity and linearity.

The 3530 offers all standard [3500 Series features](#), including selectable digital smoothing; custom 15-segment linearization; HI/LO limit monitoring with logic I/O; scalable analog output; analog +peak capture; automatic tare offset; digital track and hold; and either single-node (RS232) or multinode network



(RS485) communications. The instrument can be completely set up and operated either through the front-panel keypad or via simple  
(cont'd)

## LVDT CONDITIONER SPECIFICATIONS

**Input Type:** Series-opposed 5- or 7-wire LVDT sensor or 3- or 5-wire variable reluctance transducer capable of 3280-Hz operation and having primary impedance of 80 Ω or greater

**Input Ranges (full-scale):** "Normal": 0-150, 0-300, and 0-600 mV/V; "Long-Stroke": 0-1, 0-2, and 0-4 V/V

**Excitation Supplied:** Nominal 3 V-AC (rms) at 3280 Hz; 40 mA max.

**Common-Mode Range:** ±5 V operating; ±12 V without instrument damage

**Common-Mode Rejection Ratio:** Infinite at DC and 60 Hz; -60 dB at 3 kHz

**Input Impedance:** Normal-Mode: 400 kΩ; Common-Mode: 100 kΩ

**Offset:** Initial: ±0.25% of full scale; vs. Temperature: ±20 ppm/°C; vs. Time: ±10 ppm/month

**Gain Accuracy:** ±0.02% of full scale ± 1 count LSD, *typical*, following calibration

**Gain Stability:** Vs. Temperature: ±50 ppm/°C; vs. Time: ±20 ppm/month

**Analog Filtering:**

**Fixed:** 100 Hz

**Selectable:** 5-pole filter with selectable low-pass corner frequency of 5, 10, or 20 Hz

Response at . . .	Corner Frequency		
	5 Hz	10 Hz	20 Hz
-3 dB	5 Hz	10 Hz	20 Hz
-60 dB	32 Hz	65 Hz	125 Hz
Step Response Settling Time (Full-Scale Output)	5 Hz	10 Hz	20 Hz
To 1% of final value	250 ms	125 ms	60 ms
To 0.1% of final value	400 ms	200 ms	100 ms
To 0.02% of final value	600 ms	300 ms	170 ms

**Peak Capture:** Positive analog peak, digitally held for indefinite display; minimum full-scale input pulse duration is 15 msec (to 1% of full-scale accuracy), 25 msec (to 0.1% of full-scale accuracy), and 35 msec (to 0.02% of full-scale accuracy); PEAK and TRACK modes controlled by front-panel button, rear-panel logic input (see [Fig. 35.6](#)), or computer-port command

**Analog Output:** See [General Specifications](#)

**Frequency Characteristics and Step Response Settling Times:**

**After (A) FIXED ANALOG FILTER and after (B) +PEAK in "PEAK" or "TRACK" Mode:** -3 dB at 100 Hz; -60 dB at 750 Hz; settling time to 1% of final value: 15 msec; to 0.1% of final value: 25 msec; to 0.02% of final value: 35 msec

**After (C) SELECTABLE ANALOG FILTER:** See **Analog Filtering (Selectable)**, above

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**Go To GENERAL 3500 SERIES  
DESCRIPTION & SPECS**

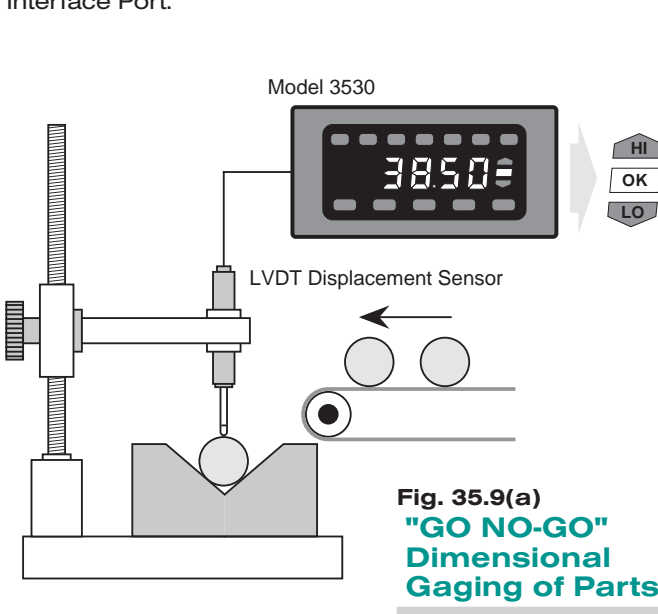


# MODEL 3530

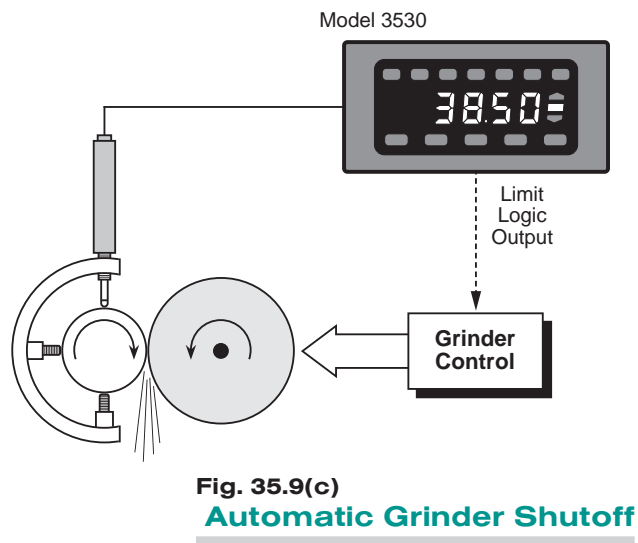
## LVDT CONDITIONER *(cont'd)*

[mnemonic commands](#) received from an external computer or terminal through the RS232/RS485 Interface Port.

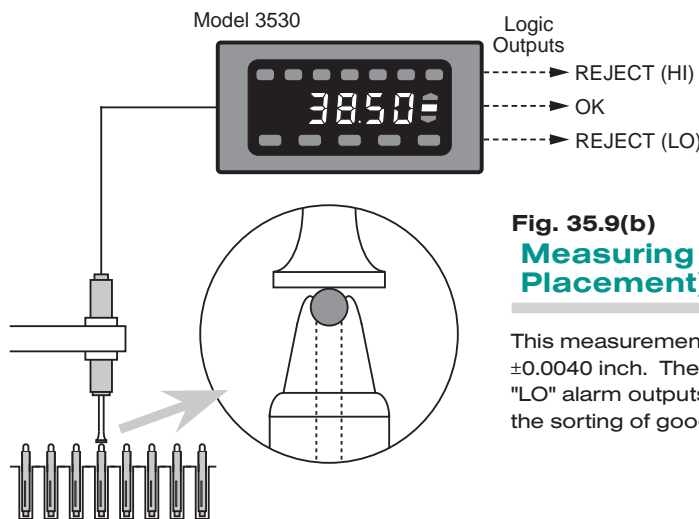
See [General Specifications](#).



**Fig. 35.9(a)**  
**"GO NO-GO"**  
**Dimensional Gaging of Parts**



**Fig. 35.9(c)**  
**Automatic Grinder Shutoff**



**Fig. 35.9(b)**  
**Measuring Tip Height (= Bearing Placement) of Ball Point Pens**

This measurement must be within  $\pm 0.0040$  inch. The 3530's "HI", "OK", and "LO" alarm outputs activate solenoids for the sorting of good and bad pens.



# MODEL 3540 FREQUENCY CONDITIONER

The **Model 3540** is used for measurement of *flow*, *rpm*, and other phenomena that can be sensed by pulse transformer transducers with two-wire isolated windings (tachometer pickups, turbine flowmeters, etc.), transistor or logic-circuit drivers, "zero-velocity" (true digital output) sensors, and similar **frequency-generating transducers**. It will accept virtually any AC or unipolar pulse input signal, floating or grounded.

The 3540's analog-input threshold level is selectable to accommodate signals from 100 mV to 100 V, thus

guaranteeing reliable triggering when the input is at the low end of the frequency range. Capacitive coupling of 0.1  $\mu\text{F}$  is provided for low-frequency inputs, to eliminate false triggering by signal noise or any DC offset that exists for the frequency signal. For "zero-velocity" sensors,  $\pm 5$  V-DC excitation is supplied.

When you know the manufacturer-supplied full-scale rating of the frequency source (or the highest frequency expected to be measured), the Model 3540's measurement channel can be quickly and



easily calibrated by issuing a special command (**FRQ**) through the RS232/RS485 Interface Port.

(cont'd)

## FREQUENCY CONDITIONER SPECIFICATIONS

**Input Type:** Any AC or unipolar pulse signal, grounded or floating, irrespective of waveform

**Frequency Range:** From 10% to 100% of 250, 500, 1000, 2000, 4000, 8000, 16000, or 32000 Hz

**Threshold Level:** Selectable to accommodate signals from 100 mV to 100 V

**Excitation Supplied (for "Zero-Velocity" sensors):** Nominal  $\pm 5$  V-DC  $\pm 5\%$ ;  $\pm 50$  mA max.

**Normal-Mode Range:**  $\pm 100$  V operating;  $\pm 150$  V without instrument damage

**Common-Mode Range:**  $\pm 100$  V operating and without instrument damage

**Common-Mode Rejection Ratio:** -120 dB at 60 Hz; -60 dB at 1 kHz

**Input Impedance:** Normal-Mode: 200 k $\Omega$ ; Common-Mode: 50 k $\Omega$

**Offset:** Initial:  $\pm 0.05\%$  of full scale; vs. Temperature:  $\pm 25$  ppm/ $^{\circ}\text{C}$ ; vs. Time:  $\pm 20$  ppm/month

**Gain Accuracy:**  $\pm 0.02\%$  of full scale  $\pm 1$  count LSD

**Gain Stability:** Vs. Temperature:  $\pm 40$  ppm/ $^{\circ}\text{C}$ ; vs. Time:  $\pm 20$  ppm/month

### Analog Filtering:

5-pole filter with selectable low-pass corner frequency of 2.5, 5, or 10 Hz

Response at . . .	Corner Frequency		
	2.5 Hz	5 Hz	10 Hz
-3 dB	2.5 Hz	5 Hz	10 Hz
-60 dB	15 Hz	32 Hz	65 Hz

### Step Response Settling Time (Full-Scale Output)

	2.5 Hz	5 Hz	10 Hz
To 1% of final value	450 ms	275 ms	150 ms
To 0.1% of final value	850 ms	425 ms	225 ms
To 0.02% of final value	1.3 s	650 ms	350 ms

**Peak Capture (Digital):** Displays the most positive measurement reading, which is digitally held for indefinite display; PEAK and TRACK modes controlled by front-panel button, rear-panel logic input (see [Fig. 35.6](#)), or computer-port command

**Analog Output:** See [General Specifications](#)

**Frequency Characteristics and Step Response Settling Times:** See [Analog Filtering](#), above

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# MODEL 3540

## FREQUENCY CONDITIONER *(cont'd)*

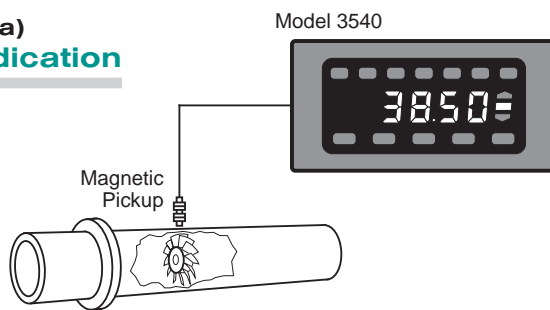
With the exception of *analog* peak capture, the 3540 offers all standard [3500 Series features](#), including selectable digital smoothing; custom 15-segment linearization; HI/LO limit monitoring with logic I/O; scalable analog output; automatic tare

offset; digital track and hold; and either single-node (RS232) or multinode network (RS485) communications. The instrument can be completely set up and operated either through the front-panel keypad or via simple [mnemonic com-](#)

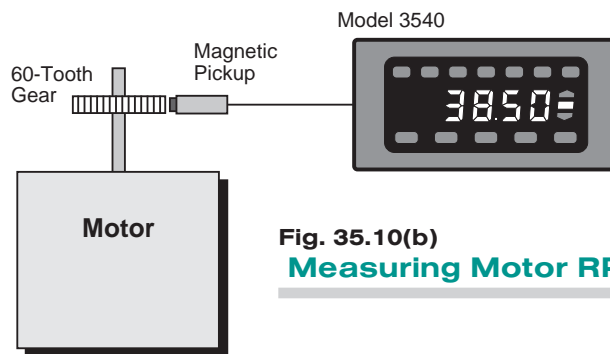
[mands](#) received from an external computer or terminal through the RS232/RS485 Interface Port.

See [General Specifications](#).

**Fig. 35.10(a)**  
**Flow Indication**



**Fig. 35.10(b)**  
**Measuring Motor RPM**





# MODEL 3560 VOLTAGE CONDITIONER

The **Model 3560 Voltage Conditioner** is a general-purpose instrument for conditioning, displaying, and monitoring the signal received from a *DC-to-DC LVDT, potentiometer-type sensor, or other external two-wire voltage source*, either floating or grounded. The input signal may also represent output from some other instrument or instrument system.  $\pm 12$ -V excitation is supplied for sources that require it.

Differential inputs, generous common-mode range, and excellent

common-mode rejection eliminate ground-coupling errors and other problems normally associated with off-ground signal sources. Chopper-stabilized DC amplification with active low-pass filtering yields smooth and stable measurement of the true average value of the input variable, even in the face of substantial dynamic content.

Simple two-point "zero and span" calibration is provided for applications where the measured quantity



is an analog of the received voltage input. For direct voltage measurements, no calibration is required.

(cont'd)

## VOLTAGE CONDITIONER SPECIFICATIONS

**Input Type:** 2-wire DC voltage source, floating or grounded

**Input Ranges (full-scale):**  $\pm 0.5$ ,  $\pm 1.0$ ,  $\pm 2.0$ ,  $\pm 5.0$ ,  $\pm 10.0$ , and  $\pm 20.0$  V-DC

**Excitation Supplied:**  $\pm 12$  V-DC  $\pm 5\%$ ;  $\pm 50$  mA max.

**Common-Mode Range:**  $\pm 50$  V operating;  $\pm 100$  V without instrument damage

**Common-Mode Rejection Ratio:** -70 dB at DC; -90 dB at 60 Hz and 3 kHz; -80 dB at 1 kHz

**Input Impedance:** Differential: 200 k $\Omega$ ; Common-Mode: 50 k $\Omega$

**Offset:** Initial:  $\pm 0.02\%$  of full scale; vs. Temperature:  $\pm 25$  ppm/ $^{\circ}$ C; vs. Time:  $\pm 10$  ppm/month

**Gain Accuracy:**  $\pm 0.02\%$  of full scale  $\pm 1$  count LSD, *typical*, following calibration\*

**Gain Stability:** Vs. Temperature:  $\pm 50$  ppm/ $^{\circ}$ C; vs. Time:  $\pm 20$  ppm/month

**Analog Filtering:**

**Fixed:** 2 kHz

**Selectable:** 5-pole filter with selectable low-pass corner frequency of 5, 10, or 20 Hz

Response at . . .	Corner Frequency		
	5 Hz	10 Hz	20 Hz
-3 dB	5 Hz	10 Hz	20 Hz
-60 dB	32 Hz	65 Hz	125 Hz

**Step Response Settling**

Time (Full-Scale Output)	5 Hz	10 Hz	20 Hz
To 1% of final value	250 ms	125 ms	60 ms
To 0.1% of final value	400 ms	200 ms	100 ms
To 0.02% of final value	600 ms	300 ms	170 ms

**Peak Capture:** Positive analog peak, digitally held for indefinite display; minimum full-scale input pulse duration is 6 msec (to 1% of full-scale accuracy), 12 msec (to 0.1% of full-scale accuracy), and 20 msec (to 0.02% of full-scale accuracy); PEAK and TRACK modes controlled by front-panel button, rear-panel logic input (see [Fig. 35.6](#)), or computer-port command

**Analog Output:** See [General Specifications](#)

**Frequency Characteristics and Step Response Settling Times:**

**After (A) FIXED ANALOG FILTER or after (B) +PEAK in "TRACK" Mode:** -3 dB at 2 kHz; -60 dB at 16 kHz; settling time to 1% of final value: 0.6 msec; to 0.1% of final value: 0.75 msec; to 0.02% of final value: 1.25 msec

**After (B) +PEAK in "PEAK" Mode:** Settling time to 1% of final value: 6 msec; to 0.1% of final value: 12 msec; to 0.02% of final value: 20 msec

**After (C) SELECTABLE ANALOG FILTER:** See **Analog Filtering (Selectable)**, above

\* Initial (uncalibrated) inaccuracy may be as great as  $\pm 0.04\%$  of full scale. Maximum error that could occur upon replacement of the Model 3560 *not followed by calibration* is  $\pm 0.08\%$  of full scale.



# MODEL 3560

## VOLTAGE CONDITIONER *(cont'd)*

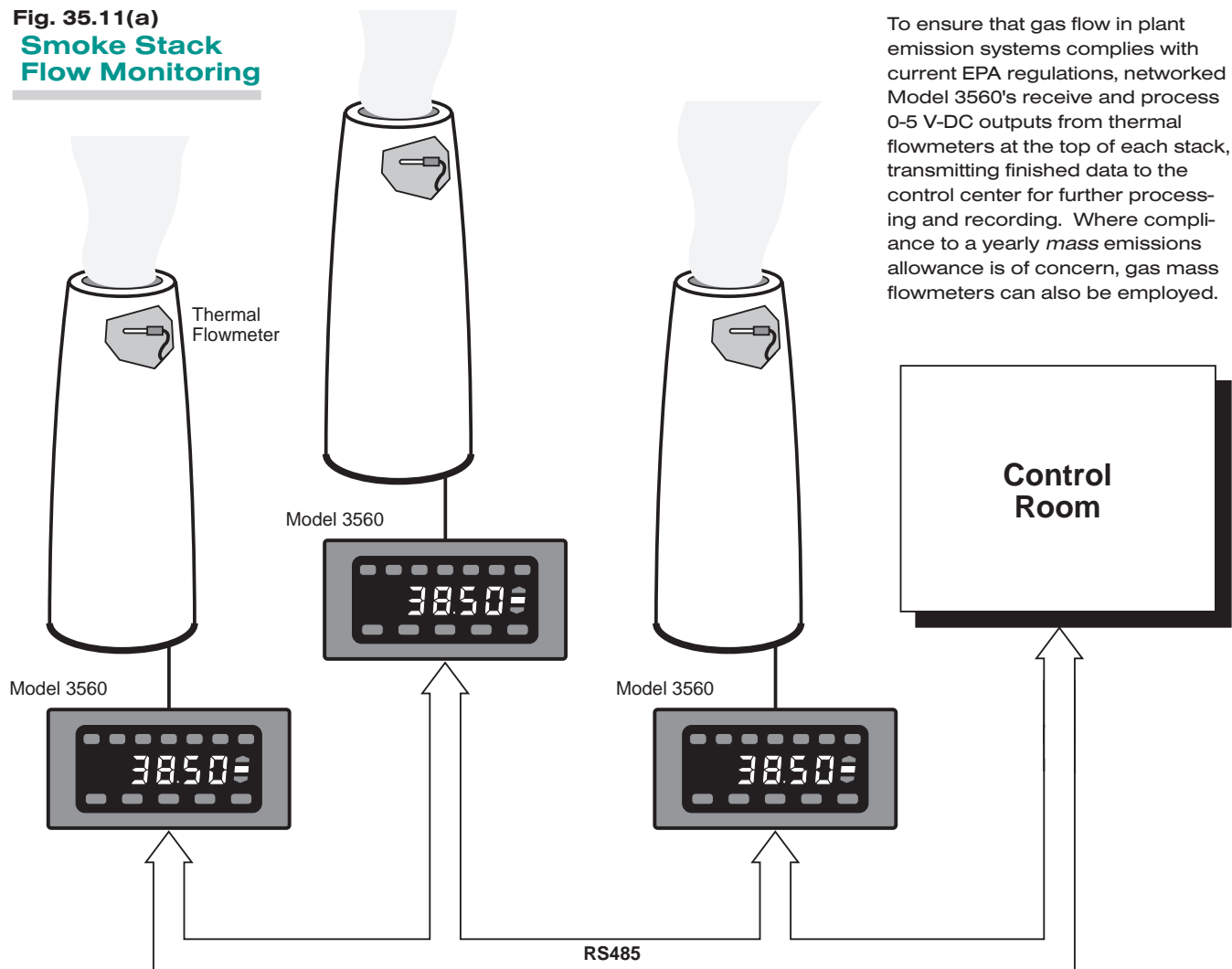
The 3560 offers all standard [3500 Series features](#), including selectable digital smoothing; custom 15-segment linearization; HI/LO limit monitoring with logic I/O; scalable analog output; analog +peak cap-

ture; automatic tare offset; digital track and hold; and either single-node (RS232) or multinode network (RS485) communications. The instrument can be completely set up and operated either through the front-panel keypad or via simple

[mnemonic commands](#) received from an external computer or terminal through the RS232/RS485 Interface Port.

See [General Specifications](#).

**Fig. 35.11(a)**  
**Smoke Stack Flow Monitoring**



To ensure that gas flow in plant emission systems complies with current EPA regulations, networked Model 3560's receive and process 0-5 V-DC outputs from thermal flowmeters at the top of each stack, transmitting finished data to the control center for further processing and recording. Where compliance to a yearly mass emissions allowance is of concern, gas mass flowmeters can also be employed.

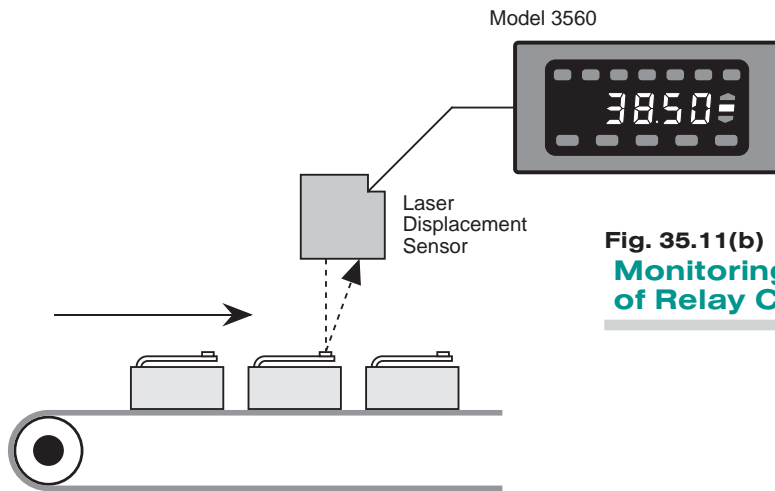
*(cont'd)*





**MODEL**  
**3560**

**VOLTAGE CONDITIONER** (*cont'd*)



**Fig. 35.11(b)**  
**Monitoring Height of Relay Contact**

INTRODUCTION

2000 SERIES

3000 SERIES

3500 SERIES

4000 SERIES



# MODEL 3570 DC STRAIN GAGE CONDITIONER

The **Model 3570 DC Strain Gage Conditioner** is a general-purpose instrument for input of *pressure, force, torque, weight,* and other variables measured by **DC-excited strain gage transducers**. It accepts a single input from any conventional 4-arm strain gage bridge, nominal 120 Ω or higher, with a full-scale range of 0.75, 1.5 or 3.0 mV/V. Optional bridge-completion circuitry—see the [Model](#)

[10CJB-2](#), below—allows input from a 2-wire 1/4-bridge, 3-wire 1/4-bridge, or 1/2-bridge gage configuration, as shown in [Fig. 35.12\(c\)](#).

Advanced circuit design overcomes many of the errors traditionally afflicting the strain gage measurement process, resulting in rock-solid digital indication and noise-free analog output.



(cont'd)

## DC STRAIN GAGE CONDITIONER SPECIFICATIONS

**Input Type:** Conventional 4-arm strain gage bridge, nominal 120 Ω or higher

**NOTE:** 1/4- and 1/2-bridge gage configurations can be accomplished by means of the [Model 10CJB-2 Bridge Completion Card](#), or by equivalent external bridge completion circuitry supplied by the user.

**Input Ranges (full-scale)\*:**

Nominal Input Range	Actual Normal-Mode Input-Signal Voltage (Max)	Absolute Maximum Overrange (50%)	Input at which Display Reading Corresponds to "m" Term
3.0 mV/V	45 mV	4.5 mV/V	4.0 mV/V
1.5 mV/V	22.5 mV	2.25 mV/V	2.0 mV/V
0.75 mV/V	11.25 mV	1.125 mV/V	1.0 mV/V

**Excitation Supplied:** Selectable 10, 5, or 2 V-DC; 85 mA max.

**Normal-Mode Range:** ±45 mV operating; ±8 V without instrument damage

**Common-Mode Range:** ±0.50 V operating; ±8 V without instrument damage

**Common-Mode Rejection Ratio:** -60 dB at DC; -90 dB at 60 Hz, 1 kHz, and 3 kHz

\* Since channel zeroing is by digital techniques, no input balance control is provided. The allowable input range, therefore, must include an *initial unbalance* (which, in commercially produced strain gage transducers, is negligible). Other transducers may have to be externally trimmed to be used with the Model 3570, if zero unbalance exceeds 20% of full scale.

\*\* Initial (uncalibrated) inaccuracy may be as great as ±0.05% of full scale. Maximum error that could occur upon replacement of the Model 3570 *not followed by calibration* is ±0.1% of full scale.

**Input Impedance (Differential and Common-Mode):** Greater than 100 MΩ

**Offset:** Initial: ±0.025% of full scale; vs. Temperature: ±25 ppm/°C; vs. Time: ±10 ppm/month

**Gain Accuracy:** ±0.02% of full scale ± 1 count LSD, *typical*, following calibration\*\*

**Gain Stability:** Vs. Temperature: ±50 ppm/°C; vs. Time: ±20 ppm/month

**Analog Filtering:**

**Fixed:** 2 kHz

**Selectable:** 5-pole filter with selectable low-pass corner frequency of 5, 10, or 20 Hz

Response at . . .	Corner Frequency		
	5 Hz	10 Hz	20 Hz
-3 dB	5 Hz	10 Hz	20 Hz
-60 dB	32 Hz	65 Hz	125 Hz

**Step Response Settling Time (Full-Scale Output)**

	5 Hz	10 Hz	20 Hz
To 1% of final value	250 ms	125 ms	60 ms
To 0.1% of final value	400 ms	200 ms	100 ms
To 0.02% of final value	600 ms	300 ms	170 ms

**Peak Capture:** Positive analog peak, digitally held for indefinite display; minimum full-scale input pulse duration is 6 msec (to 1% of full-scale accuracy), 12 msec (to 0.1% of full-scale accuracy), and 20 msec (to 0.02% of full-scale accuracy); PEAK and TRACK modes controlled by front-panel button, rear-panel logic input (see [Fig. 35.6](#)), or computer-port command

(cont'd)

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# MODEL 3570 DC STRAIN GAGE CONDITIONER *(cont'd)*

Other important 3570 features include

- **selectable bridge excitation** (nominal 2, 5, or 10 V-DC)
- **remote sensing and regulation of bridge excitation**—eliminates errors from temperature effects on cable resistance and yields consistently stable ratiometric measurement, unaffected by possible power-supply drift
- **input impedance in excess of 100 megohms** preserves the validity of factory calibration, prevents conversion of common-mode to normal-mode signals, and eliminates remaining errors attributable to cable resistance. Allowable cable length has virtually no practical limits.
- **selectable active low-pass filtering** smooths unwanted dynamic signal components arising

from vibration, power impulses, etc., that might prevent stable digital conversion or control action (see [Specifications](#))

Simple two-point "zero and span" calibration is provided for the 3570's input channel. In addition, a 100-k $\Omega$ , 0.1% *shunt resistor* is supplied. You can use this resistor—or one of your own—to apply an "equivalent input" for calibration purposes, when the transducer's full-scale mV/V sensitivity is accurately known. The calibration shunt may be switched in and out for either a positive or negative up-scale reading via simple commands issued to the RS232/RS485 port or by means of logic-level command signals through the rear Analog Input Connector.

A third calibration technique for the 3570 involves application of a special command ([MVV](#)) through the

RS232/RS485 Interface Port when both "mV/V" sensitivity and corresponding full-scale rating of the transducer are known.

The 3570 offers all standard [3500 Series features](#), including selectable digital smoothing, custom 15-segment linearization; HI/LO limit monitoring with logic I/O; scalable analog output; analog +peak capture; automatic tare offset; digital track and hold; and either single-node (RS232) or multinode network (RS485) communications. The instrument can be completely set up and operated either through the front-panel keypad or via simple [mnemonic commands](#) received from an external computer or terminal through the RS232/RS485 Interface Port.

See [General Specifications](#).

*(cont'd)*

## DC STRAIN GAGE CONDITIONER SPECIFICATIONS *(cont'd)*

**Analog Output\*:** See [General Specifications](#)

**Frequency Characteristics and Step Response Settling Times:**

**After (A) FIXED ANALOG FILTER or after (B) +PEAK in "TRACK" Mode:** -3 dB at 2 kHz; -60 dB at 16 kHz; set-

ting time to 1% of final value: 0.6 msec; to 0.1% of final value: 0.75 msec; to 0.02% of final value: 1.25 msec

**After (B) +PEAK in "PEAK" Mode:** Settling time to 1% of final value: 6 msec; to 0.1% of final value: 12 msec; to 0.02% of final value: 20 msec

**After (C) SELECTABLE ANALOG FILTER:** See **Analog Filtering (Selectable)**, above

\* When (1) the analog output scale is 100.0%, (2) the analog output offset is 0.0%, and (3) the selected excitation is 10 V, then any of the following inputs will result in an analog output of **5 V**: an input of 4 mV/V on the 3.0-mV/V range; an input of 2 mV/V on the 1.5-mV/V range; or an input of 1 mV/V on the 0.75-mV/V range.



# MODEL 3570

## DC STRAIN GAGE

### CONDITIONER (cont'd)

## MODEL 10CJB-2 BRIDGE COMPLETION CARD



HWD in inches/cm:  
1.14/2.90; 9.05/22.99; 3.25/8.26

Intended primarily for **stress analysis** applications, this external junction box lets you connect the Model 3570's input to a *2-wire 1/4-bridge*, *3-wire 1/4-bridge*, *1/2-bridge*, or *full-bridge* strain gage configuration

(normally attached directly to the stressed material)\*. Each 1/4-bridge configuration may use a nominal gage resistance of either 120 or 350 ohms.

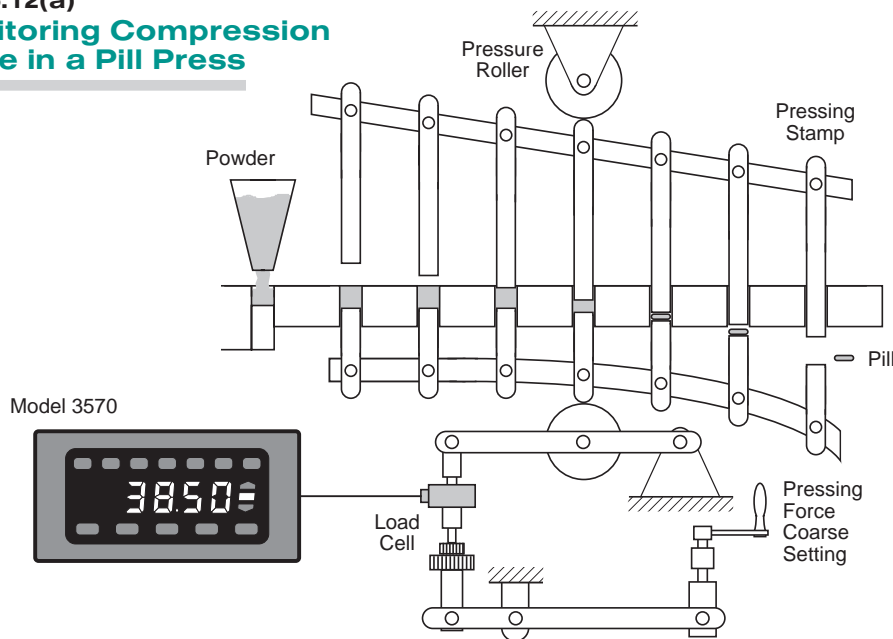
As shown in [Fig. 35.12\(c\)](#), the function of the 10CJB-2 is to "complete"

the connected partial bridge—that is, to allow it to be seen by the instrument as a full (4-arm) Wheatstone bridge.

Channels originating from the 10CJB-2 require a special calibration procedure. Also, you must furnish your own pin-to-pin shielded cable for connecting the 10CJB-2 to the 3570's Analog Input Connector. Daytronic will supply terminal connectors for this cable.

\* In such applications, the lowest (2 V) excitation level should be used to help reduce gage heating effects.

**Fig. 35.12(a)**  
**Monitoring Compression Force in a Pill Press**



(cont'd)

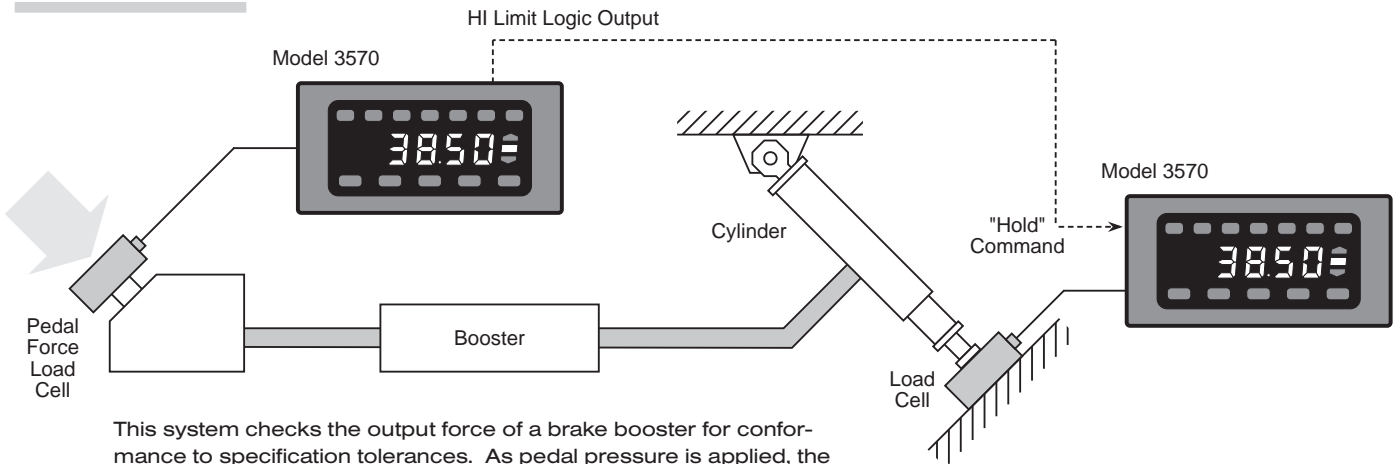


# MODEL 3570

## DC STRAIN GAGE

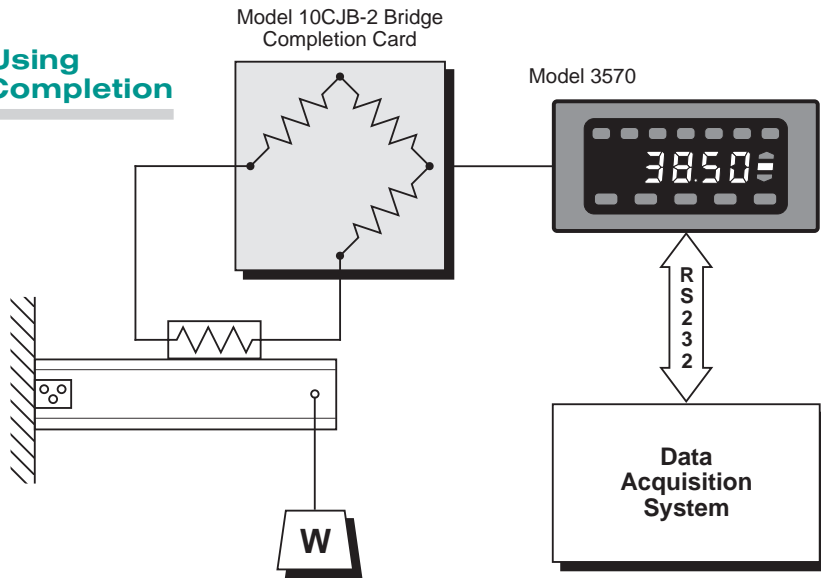
### CONDITIONER (cont'd)

**Fig. 35.12(b)**  
**Brake Testing**



This system checks the output force of a brake booster for conformance to specification tolerances. As pedal pressure is applied, the first 3570 detects passage of a preset test-point value. The "HI" limit output generated at this point is sent to the second 3570 as a logic "HOLD" command, thereby freezing the current brake force value.

**Fig. 35.12(c)**  
**Stress Analysis Using External Bridge Completion**



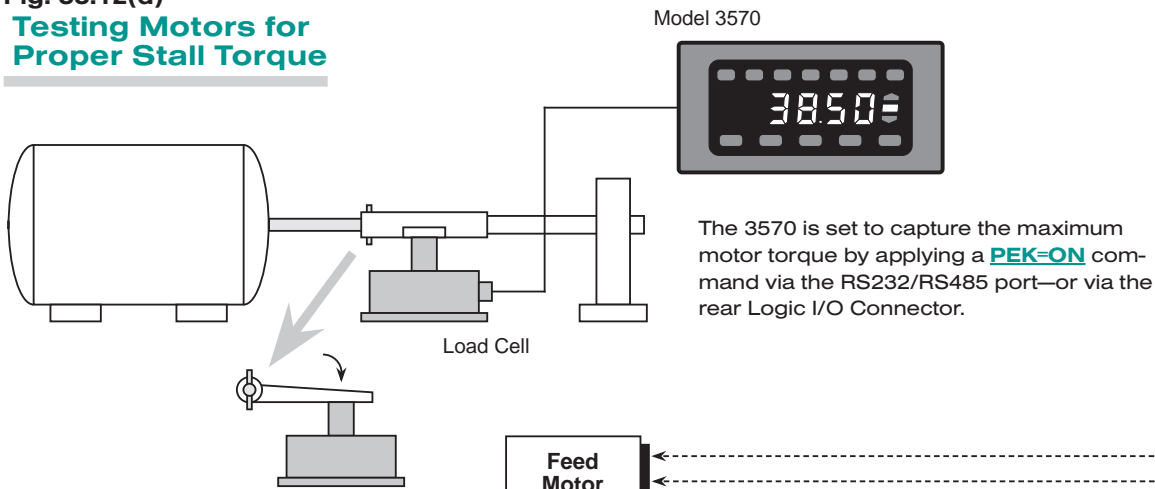
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# MODEL 3570

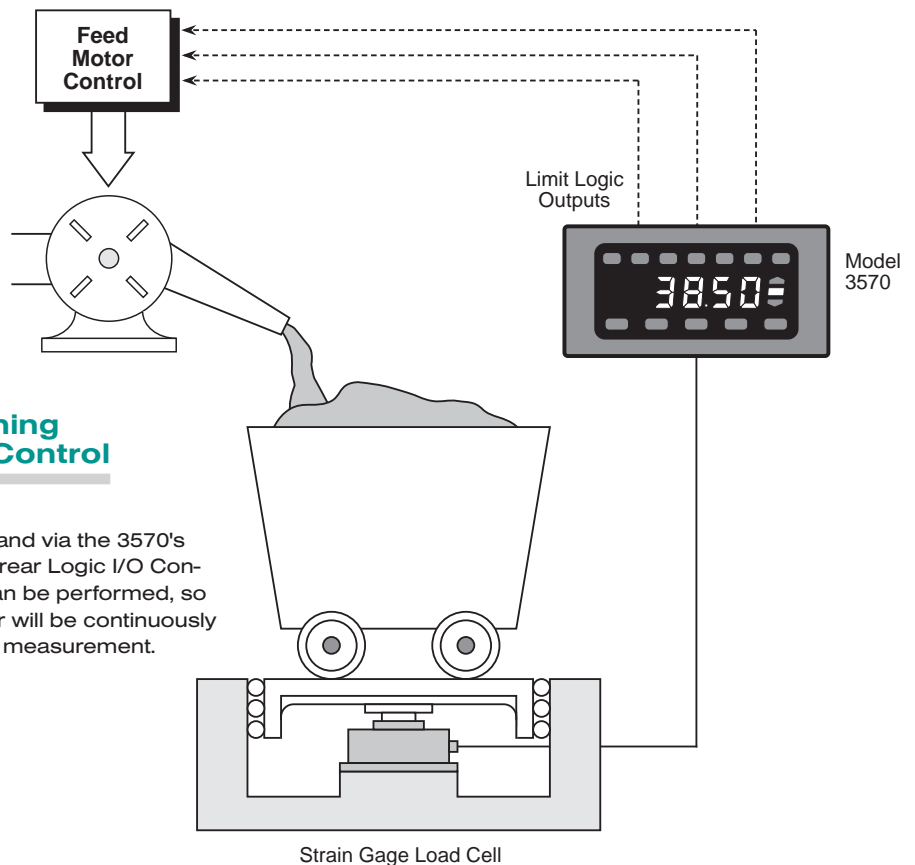
## DC STRAIN GAGE CONDITIONER *(cont'd)*

**Fig. 35.12(d)**  
**Testing Motors for Proper Stall Torque**



**Fig. 35.12(e)**  
**Batch Weighing with Motor Control**

By applying a **TAR-ON** command via the 3570's RS232/RS485 port—or via the rear Logic I/O Connector—an initial "auto-zero" can be performed, so that the weight of the container will be continuously "tared out" of the batch weight measurement.





# MODEL 3578 AC STRAIN GAGE CONDITIONER

Being a *phase-sensitive carrier-demodulator instrument* (rather than **fully DC**), the **Model 3578 AC Strain Gage Conditioner** is intended for applications involving transformer coupling to the transducer bridge (as with *rotary-transformer torque sensors*) and for applications requiring *high sensitivity with optimum signal-to-noise characteristics*—as, for

example, where the electrical environment is especially noisy and there is a need for high amplification of low signal levels.

Responding only to the modulated carrier frequency, the 3578 rejects extraneous voltages that can cause errors in DC systems. Excitation is fixed at 3 V-AC (rms) at 3280 Hz.



(cont'd)

## AC STRAIN GAGE CONDITIONER SPECIFICATIONS

**Input Type:** Conventional 4-arm strain gage bridge, nominal 90 Ω or higher

**Input Ranges (full-scale)\*:**

Nominal Input Range	Actual Normal-Mode Input-Signal Voltage (Max)	Absolute Maximum Overrange (50%)	Input at which Display Reading Corresponds to "m" Term
3.00 mV/V	13.5 mV	4.0 mV/V	4.0 mV/V
1.50 mV/V	6.75 mV	2.0 mV/V	2.0 mV/V
0.75 mV/V	3.375 mV	1.0 mV/V	1.0 mV/V

**Excitation Supplied:** Regulated 3 V-AC (rms) at 3280 Hz; 50 mA (rms) max.

**Amplifier:** AC-coupled demodulator with user-settable phase and symmetry controls

**Normal-Mode Range:** ±12 mV-AC (rms) operating; ±8 V-DC without instrument damage

**Common-Mode Range:** ±0.8 V-DC operating; ±8 V-DC without instrument damage

**Common-Mode Rejection Ratio:** Infinite at DC; -90 dB at 60 Hz; -80 dB at 1 kHz; -60 dB at 3 kHz

\* Since channel zeroing is by digital techniques, no input balance control is provided. The allowable input range, therefore, must include an *initial unbalance* (which, in commercially produced strain gage transducers, is negligible). Other transducers may have to be externally trimmed to be used with the Model 3578, if zero unbalance exceeds 20% of full scale.

\*\* Initial (uncalibrated) inaccuracy may be as great as ±3% of full scale. Maximum error that could occur upon replacement of the Model 3578 *not followed by calibration* is ±6% of full scale.

**Input Impedance (Differential and Common-Mode):** 10 MΩ

**Offset:** Initial: ±3% of full scale; vs. Temperature: ±0.005% f.s./°C; vs. Time: ±0.002% f.s./month

**Gain Accuracy:** ±0.025% of full scale ± 1 count LSD, *typical*, following calibration\*\*

**Gain Stability:** Vs. Temperature: ±50 ppm/°C; vs. Time: ±20 ppm/month

**Analog Filtering:**

**Fixed:** 20 Hz

**Selectable:** 5-pole filter with selectable low-pass corner frequency of 5, 10, or 20 Hz

Response at . . .	Corner Frequency		
	5 Hz	10 Hz	20 Hz
-3 dB	5 Hz	10 Hz	20 Hz
-60 dB	32 Hz	65 Hz	125 Hz

**Step Response Settling Time (Full-Scale Output)**

	5 Hz	10 Hz	20 Hz
To 1% of final value	250 ms	125 ms	100 ms
To 0.1% of final value	400 ms	200 ms	150 ms
To 0.02% of final value	600 ms	300 ms	225 ms

**Peak Capture:** Positive analog peak, digitally held for indefinite display; minimum full-scale input pulse duration is 100 msec (to 1% of full-scale accuracy), 150 msec (to 0.1% of full-scale accuracy), and 225 msec (to 0.02% of full-scale accuracy); PEAK and TRACK modes controlled by front-panel button, rear-panel logic input (see [Fig. 35.6](#)), or computer-port command

(cont'd)

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# MODEL 3578 AC STRAIN GAGE CONDITIONER *(cont'd)*

Other important 3578 features include

- **remote sensing and regulation of bridge excitation**—eliminates errors from temperature effects on cable resistance and yields consistently stable ratiometric measurement, unaffected by possible power-supply drift
- **high input impedance** preserves the validity of factory calibration, prevents conversion of common-mode to normal-mode signals, and eliminates remaining errors attributable to cable resistance. Allowable cable length has virtually no practical limits.
- **user-settable phase and symmetry controls** for accurate calibration
- **selectable active low-pass filtering** smooths unwanted

dynamic signal components arising from vibration, power impulses, etc., that might prevent stable digital conversion or control action (see [Specifications](#))

Simple two-point "zero and span" calibration is provided for the 3570's input channel. In addition, a 100-k $\Omega$ , 0.1% *shunt resistor* is supplied. You can use this resistor—or one of your own—to apply an "equivalent input" for calibration purposes, when the transducer's full-scale mV/V sensitivity is accurately known. The calibration shunt may be switched in and out for either a positive or negative up-scale reading via simple commands issued to the RS232/RS485 port.\*

The 3578 offers all standard [3500 Series features](#), including selectable digital smoothing; custom 15-segment linearization; HI/LO limit

monitoring with logic I/O; scalable analog output; analog +peak capture; automatic tare offset; digital track and hold; and either single-node (RS232) or multinode network (RS485) communications. The instrument can be completely set up and operated either through the front-panel keypad or via simple [mnemonic commands](#) received from an external computer or terminal through the RS232/RS485 Interface Port.

See [General Specifications](#).

*(cont'd)*

\* Unlike the [Model 3570 DC Strain Gage Conditioner](#), the 3578 employs the special Conditioner Connector shown in [Fig. 35.2\(a\)](#), which requires direct solder-terminal attachment of cable leads, and does not permit the input of logic-level signals for control of shunt calibration. Also, the Model 3578 cannot be calibrated by means of the software **MVV** command.

## AC STRAIN GAGE CONDITIONER SPECIFICATIONS *(cont'd)*

**Analog Output\*\*:** See [General Specifications](#)

**Frequency Characteristics and Step Response Settling Times:**

After (A) **FIXED ANALOG FILTER** and after (B) **+PEAK** in "PEAK" or "TRACK" Mode: -3 dB at 20 Hz; -60 dB at

250 Hz; settling time to 1% of final value: 100 msec; to 0.1% of final value: 150 msec; to 0.02% of final value: 225 msec

After (C) **SELECTABLE ANALOG FILTER:** See **Analog Filtering (Selectable)**, above

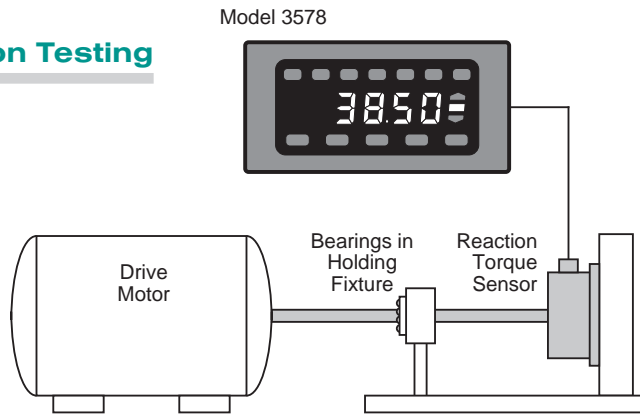
\*\* When the analog output scale is 100.0% and the analog output offset is 0.0%, then any of the following inputs will result in an analog output of **5 V**: an input of 4 mV/V on the 3.0-mV/V range; an input of 2 mV/V on the 1.5-mV/V range; or an input of 1 mV/V on the 0.75-mV/V range.





**MODEL**  
**3578**  
**AC STRAIN GAGE**  
**CONDITIONER (cont'd)**

**Fig. 35.13**  
**Bearing Friction Testing**



# SUMMARY OF 3500 SERIES MNEMONIC COMMANDS

## SETUP COMMANDS

### AOG (ANALOG OUTPUT GAIN)

Sets or reads the analog output gain (a percentage of full scale between 74.4% and 125.6%).

### AOO (ANALOG OUTPUT OFFSET)

Sets or reads the analog output offset (a percentage of full scale between -25.6% and 25.6%).

### BAU (BAUD RATE)

Sets or reads protocols for the RS232/RS485 Interface Port: baud rate (300 through 153.6K), number of stop bits (1 or 2), number of data bits (7 or 8), and parity (even, odd, none, or zero).

### BEE (ZERO OFFSET)

Sets or reads the zero offset ("b" term) to be applied to the data reading.

### CAL (CALIBRATION)

Sets or reads the active calibration method ("Two-Point" or "15-Segment Linearization").

### CMT (COMMAND TERMINATOR)

Sets or reads the single ASCII character to be recognized as the "command terminator" for all commands received via the RS232/RS485 Interface Port.

### EMM (SCALING FACTOR)

Sets or reads the scaling factor ("m" coefficient) to be applied to the data reading. Also sets desired measurement precision (decimal-point location).

### EOT (END-OF-TRANSMISSION TERMINATOR)

Sets or reads the string of up to four ASCII characters to be used as end-of-transmission terminator for the RS232/RS485 Interface Port.

### EUS (ENGINEERING UNIT STRING)

Sets or reads the "tailer" string of up to 8 characters for all transmissions in response to a **CHN** or **DMP** command.

### EXC (EXCITATION)—*Model 3570 only*

Sets or reads the excitation level (2, 5, or 10 V).

### FIL (FILTER)

Sets or reads the digital filtering constant (0 through 9).

### FRC (FORCE)

Sets the scaling factor ("m" coefficient) so that the existing input yields a specified reading. Also sets desired precision (decimal-point location). There is no valid "read" form of the command.

### FRQ (FREQUENCY CALIBRATION)—*Model 3540 only*

Sets an appropriate scaling factor based on the nominal full-scale rating of the frequency source (or the highest frequency expected to be measured) and the corresponding value of the measured phenomenon, expressed in the desired

engineering units and precision. "Read" form of the command returns current "FRQ" calibration constants.

### HHY (HIGH HYSTERESIS)

Sets or reads the HIGH hysteresis window depth (a percentage of the existing scaling factor value).

### HIL (HIGH LIMIT)

Sets or reads the HIGH limit value.

### HLA (HIGH LATCH)

Sets or reads "latch" status of the HIGH limit.

### LBL (LABEL)

Sets or reads the "header" string of up to 8 characters for all transmissions in response to a **CHN** or **DMP** command.

### LFC (LINEARIZATION FORCE)

Sets the output value for the linearization segment corresponding to the existing "live" input. There is no valid "read" form of the command.

### LHY (LOW HYSTERESIS)

Sets or reads the LOW hysteresis window depth (a percentage of the existing scaling factor value).

### LIN (LINEARIZE)

Sets or reads the effective endpoint of a given linearization segment (expressed in terms of mV input and desired engineering-unit output).

### LLA (LOW LATCH)

Sets or reads "latch" status of the LOW limit.

### LOL (LOW LIMIT)

Sets or reads the LOW limit value.

### MVV (MV/V CALIBRATION)—*Model 3570 only*

Sets an appropriate scaling factor based on the transducer sensitivity rating in mV/V, full scale, and the nominal full-scale rating of the transducer expressed in the desired engineering units and precision. "Read" form of the command returns current **MVV** calibration constants.

### PRI (PRINT INTERVAL)

Sets or reads the time interval for the automatic print function (for RS232 mode only).

### RES (RESPONSE)

Sets or reads the analog filter corner.

### RNG (RANGE)

Sets or reads the input range (or unit scale).

### SCD (SECURITY CODE)

Sets or reads the security code number (0 through 98), which must be entered via the front panel before configuration changes can be made via the front panel.

(cont'd)

# SUMMARY OF 3500 SERIES MNEMONIC COMMANDS (*cont'd*)

## SETUP COMMANDS (*cont'd*)

**SEN (SENSITIVITY)**—*Model 3540 only*  
Sets or reads the input sensitivity.

**TRR (TARE REGISTER)**  
Sets or reads the tare register value.

**ZRO (ZERO)**  
Sets the zero offset ("b" term) so that the existing input yields a specified reading. There is no valid "read" form of the command.

## RUN-TIME COMMANDS

**CHN (CHANNEL)**  
Reads the current measurement data. Outputs **LBLn,w,sEUS [EOT]** from the RS232/RS485 Interface Port, where LBL = optional header string, n = optional node number, w = data value, s = optional limit-zone indicator number, EUS = optional tailer string, and [EOT] = end-of-transmission terminator.

**DMP (DUMP)**  
Same as **CHN** command.

**ECO (ECHO)**  
Enables or disables node-number "echo" for all transmissions in response to a **CHN** or **DMP** command. "Read" form of the command returns current node-number "echo" status.

**LIM (LIMITS)**  
Enables or disables limit-zone indication for all transmissions in response to a **CHN** or **DMP** command. "Read" form of the command returns current limit-indication status.

**LNR (LINEARIZER RESET)**  
Resets the internal linearization table and sets the active calibration mode to "MXB."

**LNS (LINEARIZATION SEGMENTS)**  
Reads the number of currently active linearization segments.

**NOD (NODE)**  
Reads the node number of the currently "open" node.

**OPN (OPEN)**  
"Opens" a single specified network node (only) for RS485 communications with the supervisory computer.

**PEK (PEAK)**  
Enables or disables the "+PEAK" mode. "Read" form of the command returns current "+PEAK" status.

**PRN (PRINT ENABLE)**  
Enables or disables the automatic print function (for RS232 mode only). "Read" form of the command returns current "print enable" status.

**RLS (RELEASE)**  
Releases both the high-limit latch and the low-limit latch, returning to a "live" state the logic output and front-panel indicator associated with each limit.

**SAV (SAVE)**  
Saves the existing setup configuration (including calibration data) to nonvolatile EEPROM. "Read" form of the command returns current "SAVE" status (i.e., whether or not a "SAVE" is currently in progress).

**SHN (SHUNT CALIBRATE-NEGATIVE)**—*Model 3570 only*  
Closes the shunt-calibration switch for a negative up-scale reading, or opens the switch to resume normal measurement. "Read" form of the command returns current status of the negative shunt-calibration switch.

**SHP (SHUNT CALIBRATE-POSITIVE)**—*Model 3570 only*  
Closes the shunt-calibration switch for a positive up-scale reading, or opens the switch to resume normal measurement. "Read" form of the command returns current status of the positive shunt-calibration switch.

**TAR (TARE)**  
Enables or disables the "tare" mode. "Read" form of the command returns current "tare" status.

**VER (VERSION)**  
Transmits instrument version information (model number and software version level) from the RS232/RS485 Interface Port.