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Installation and operating instructions

Batch Controller & Ticker Printer TP- 709

Note

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Please read these installation and operating instructions carefully. All instructions in this manual must be followed exactly to ensure proper operation of the unit.

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1 Introduction

The TP-709 system uses a Contrec batch controller to accept pulse or frequency flow signals and automatically control the batching of fluids via a one- or two-stage control valve.

The instruments are extremely flexible and easy to operate, with a four-key front panel interface that enables the batch quantity to be set, and batches to be started or stopped.

This manual covers systems incorporating either the **Contrec 414** or the **Contrec 424** Batch Controller. While both versions share core functionality, the 424 is the current production model and introduces a number of enhancements, including a universal power supply, RS485 communication as standard, selectable pulse output widths, and a backlit LCD display for improved readability.

Model 414

The Model 414 Batch Controller has been widely deployed in TP-709 systems and remains fully supported for the installed base.

- **Model 414D**: Accepts most frequency and pulse signals, including mV outputs from turbine flowmeters and 2-wire proximity switch outputs. It also enables all four front panel switches to be remotely connected via the rear terminal strip. The Model 414D includes a scaled pulse output for driving remote counters and provides a flow alarm output.
- **Model 414B**: Accepts basic pulse and square-wave signals. Only the RUN and STOP switches are available via the rear terminals.

Model 424

The Model 424 replaces the 414 in current TP-709 production systems. It retains backward-compatible operation while introducing the following enhancements:

- Universal power supply (12–28.5 VDC or 100–240 VAC) without reconfiguration.
- RS232 and RS485 interfaces provided as standard for printer or host communication.
- Selectable open-collector pulse outputs (1 ms, 10 ms, or 100 ms).
- Updated terminal layout for simplified wiring and maintenance.
- Backlit 6-digit LCD display for improved visibility in all environments.

Both the 414 and 424 are fully programmable, with all calculation constants set via the front panel switches and stored permanently in non-volatile memory.

1.1 Overview of the TP-709 System

The TP-709 system accepts pulse or frequency flowmeter signals and automatically controls batching via one or two control relays. It can display:

- **Batch Total** – quantity delivered in the current batch,

- **Accumulated Total** – non-resettable totalizer for long-term tracking,
- **Flow Rate** – displayed in user-defined engineering units,
- **Preset Quantity** – target batch size for the current operation.

Both controllers feature:

- **Dual-relay control** for single- or two-stage valve operation,
- **Automatic overrun compensation** based on previous batches,
- **Remote start/stop** inputs,
- **Signal timeout detection** for flow monitoring,
- **End-of-batch signaling** for external devices,
- **Optional serial communication** for printers and host systems,
- **Panel, field, or explosionproof enclosures** (optional).

1.2 About the Contrec 414 Batch Controller

The **Model 414** has been widely deployed in TP-709 systems and remains fully supported for installed applications.

- **Display:** 6-digit LCD, 0.7" high characters.
- **Inputs:** Versions for pulse, square-wave, coil, or 4–20 mA signals (depending on model variant).
- **Outputs:** Two independent relay outputs (5 A max), scaled pulse output (Model 414D only), and optional RS232/422/485 communication.
- **Power:** 11.5–28.5 VDC or internally configured 95–135 VAC / 190–260 VAC.
- **Mounting:** Standard IP65 (NEMA 4X) panel enclosure, with optional field or explosionproof housings.

Model variants (e.g., 414B, 414D) provide compatibility with a range of flowmeter signal types. See Section 2 for specifications.

1.3 About the Contrec 424 Batch Controller

The **Model 424** replaces the 414 as the current production controller for TP-709 systems. It retains backward-compatible wiring and operational principles while adding:

- **Universal power supply** (12–28.5 VDC or 100–240 VAC) without internal reconfiguration,
- **RS485 communication** as a standard interface alongside RS232,
- **Selectable open-collector pulse widths** (1 ms / 10 ms / 100 ms) for flexible downstream integration,

- **Improved display** with a 6-digit backlit LCD for enhanced visibility,
- **Revised terminal layout** for simplified wiring and maintenance.

The 424 model is programmed using the same intuitive **four-button interface** as the 414, ensuring continuity for operators familiar with the previous system.

1.4 Backward Compatibility and Installed Base

While all new TP-709 systems are equipped with the 424 controller, many installations continue to operate using the 414. This manual provides configuration, wiring, and calibration instructions for **both controllers**, allowing service personnel to support existing systems and transition smoothly to the new hardware.

1.5 Model Number Designations

The model number of the 414 describes which input and output options are installed and the AC mains voltage rating.

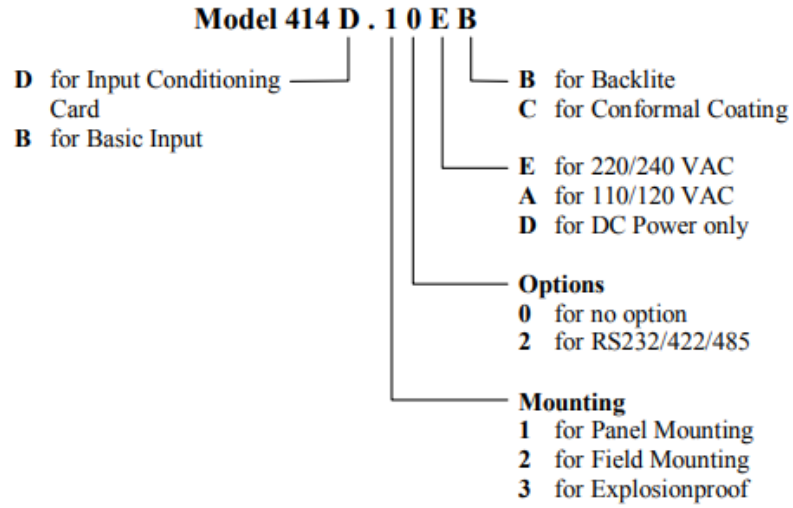


Figure 1: Model 414B/D Designations

The Model Number of the instrument for the 414 is displayed on first entering the Calibration Mode.

The model number of the instrumed for the 424 describes whic input and ouput options are installed.

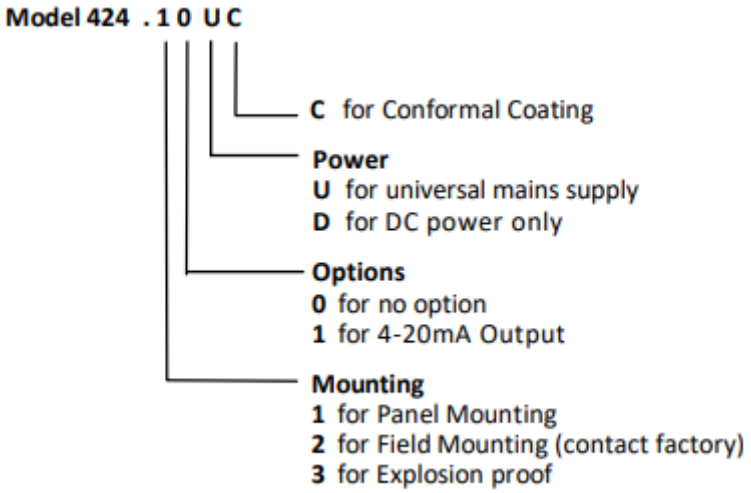


Figure 2: Model 424 Designations

The model and option of the instrument can be displayed in the Test Menu.

2 Specifications

The TP-709 batching system incorporates either the **Contrec 414** or the **Contrec 424** Batch Controller. The following specifications cover both controllers.

2.1 General Specifications

Feature	Model 414	Model 424
Display	6-digit LCD, 0.7" (17.8 mm) high characters	6-digit LCD, backlit, 0.7" (17.8 mm)
Display Update	0.25 s	0.25 s
Transducer Supply	8–24 VDC field-adjustable (50 mA max)	8–24 VDC field-adjustable (50 mA max)
Operating Temperature	0 °C to 55 °C	0 °C to 55 °C
Data Retention	10-year non-volatile memory	10-year non-volatile memory
Enclosure	IP65 (NEMA 4X) panel mount; optional field/explosionproof	IP65 (NEMA 4X) panel mount; optional field/explosionproof

Table 1: General Specifications

2.2 Electrical Specifications

Feature	Model 414	Model 424
DC Supply	11.5–28.5 VDC (130–200 mA typical)	12–28.5 VDC
AC Supply	95–135 VAC or 190–260 VAC (configured internally)	100–240 VAC universal (auto-selecting)

Table 2: Electrical Specifications

2.3 Inputs

Feature	Model 414	Model 424
Input Types	Pulse, frequency, square-wave; 414D adds mV coil, proximity, and reed switch inputs	Pulse, frequency, square-wave; coil, reed, and proximity inputs
Frequency Range	0.25 Hz – 10 kHz (8 kHz for Model 414H)	0.25 Hz – 10 kHz
Scaling Range	0.1000 – 50,000	0.1000 – 50,000
Input Impedance	10 kΩ typical (varies by mode)	10 kΩ typical (varies by mode)
Signal Timeout	Programmable 0–99 s	Programmable 0–99 s

Table 3: Inputs

2.4 Outputs

Feature	Model 414	Model 424
Relays	Two independent relays; max 1250 VA, 250 VAC / 30 VDC, 5 A	Two independent relays; max 1250 VA, 250 VAC / 30 VDC, 5 A
Pulse Output	Open collector, 10 ms pulse, 49 pps max (414D only)	Open collector, selectable 1/10/100 ms pulse width
Flow Alarm Output	Open collector (414D only)	Open collector
End of Batch Output	Open collector (programmable)	Open collector (programmable)

Table 4: Outputs

2.5 Communication

Feature	Model 414	Model 424
Interfaces	RS232 / RS422 / RS485 (optional)	RS232 / RS485 (standard)
Protocol	ASCII protocol for printer or host	ASCII protocol for printer or host
Baud Rates	300–9600 bps	300–9600 bps

Table 5: Communication

2.6 Enclosure and Mounting Options

Feature	Model 414	Model 424
Panel Dimensions	5.7" W × 2.8" H × 7.0" D (144 × 72 × 178 mm)	5.7" W × 2.8" H × 7.0" D (144 × 72 × 178 mm)
Panel Cutout	5.5" × 2.6" (139 × 67 mm)	5.5" × 2.6" (139 × 67 mm)
Field Enclosure	IP65 (NEMA 4X)	IP65 (NEMA 4X)
Explosionproof Option	Available	Available

Table 6: Enclosure and Mounting Options

2.7 Standard & Compliance

Both models conform to:

- **EMC Directive 2014/30/EU**
- **Low Voltage Directive 2014/35/EU**
- **Generic Emission Standard EN 50081-1:** Residential, Commercial & Light Industry Environment
- **Generic Emission Standard EN 50081-2:** Industrial Environment
- **Generic Immunity Standard EN 50082-1:** Residential, Commercial & Light Industry Environment
- **Generic Immunity Standard EN 50082-2:** Industrial Environment

2.8 Terminal Designations

The following tables outline the wiring terminal functions for the Contrec 414 and 424 batch controllers. These are essential for correct system integration and troubleshooting.

2.8.1 Model 414D / 414B Terminal Designations

Terminal	Function	Model
1	Calibration link	414D, 414B
2	Signal ground	414D, 414B
3	Not used	414D, 414B
4	Remote DISPLAY switch	414D only
5	Remote BATCH SET switch	414D only
6	Not used	414D, 414B
7	Flow alarm output (open collector)	414D only
8	Flow common (−)	414D, 414B
9	Flow pulse input	414D, 414B
10	Scaled pulse output (open collector)	414D only
11	DC power output (8–24 VDC, 50 mA max)	414D, 414B
12	DC ground	414D, 414B

Terminal	Function	Model
13	DC power input (12–28 VDC)	414D, 414B
14	Alternate flow signal input (voltage)	414D only
20–27	RS232/422/485 communication terminals	If optioned
28	Remote RUN switch	414D, 414B
29	Remote STOP switch	414D, 414B
30	End-of-batch / pump control output	414D, 414B
31–36	Relay 1 and Relay 2 output terminals (NO/NC/C)	414D, 414B

Table 7: Model 414 Terminal Designations

NOTE: Only RUN and STOP are available as remote switches on the 414B. Full remote operation (RUN, STOP, DISPLAY, BATCH SET) is supported on the 414D.

2.8.2 Model 424 Terminal Designations

Terminal	Function
1	Flow input (+)
2	Flow input (−)
3	Coil input (if applicable)
4	Flow common (−)
5	Shield ground
6–9	Not used
10	Remote RUN switch
11	Pulse output (open collector; configurable)
12	Flow alarm output (open collector)
13	Remote STOP switch
14	Remote BATCH SET switch
15	Remote DISPLAY switch

Terminal	Function
16–19	Not used
20	DC power output (+8–24 VDC, 50 mA max)
21	DC ground
22	DC power input (+12–28.5 VDC) or AC live
23	AC neutral (if AC powered)
24	Earth (ground)
25	RS232 TX
26	RS232 RX
27	RS232 Ground
28	RS485 A (–)
29	RS485 B (+)
30–32	Not used
33–35	Relay 1 output (NC / C / NO)
36–38	Relay 2 output (NC / C / NO)

Table 8: Model 424 Terminal Designations

NOTE: Terminal numbering may vary slightly depending on mounting format or OEM version. Refer to controller-specific wiring labels and dimensional diagrams in Section 7.

3 Operation

The Models 414 and 424 Batch Controllers use a low power CMOS microprocessor to perform all control functions and calculations. These controllers are designed for reliability and ease of use in batching operations, enabling precise delivery of fluids in hygienic and industrial applications.

Both instruments are fully programmable, with all operating parameters and calculation constants set via the front-panel keypad. These settings are stored in non-volatile memory, ensuring retention for a minimum of 10 years without the need for battery backup.

While the **424 controller** supersedes the 414 in new TP-709 systems, it retains the same intuitive four-button interface and core operating principles as the 414, ensuring a consistent

user experience. In addition, the 424 introduces a backlit display for enhanced readability and expanded communication options for integration with host systems.

This section describes the general operation of the batch controllers, including how to configure batch quantities, start and stop batching cycles, interpret the display, and utilize key features such as dual-stage valve control, flow monitoring, and automatic overrun compensation.

A functional block diagram of the controllers is provided below to illustrate the primary input and output connections used during batching operations

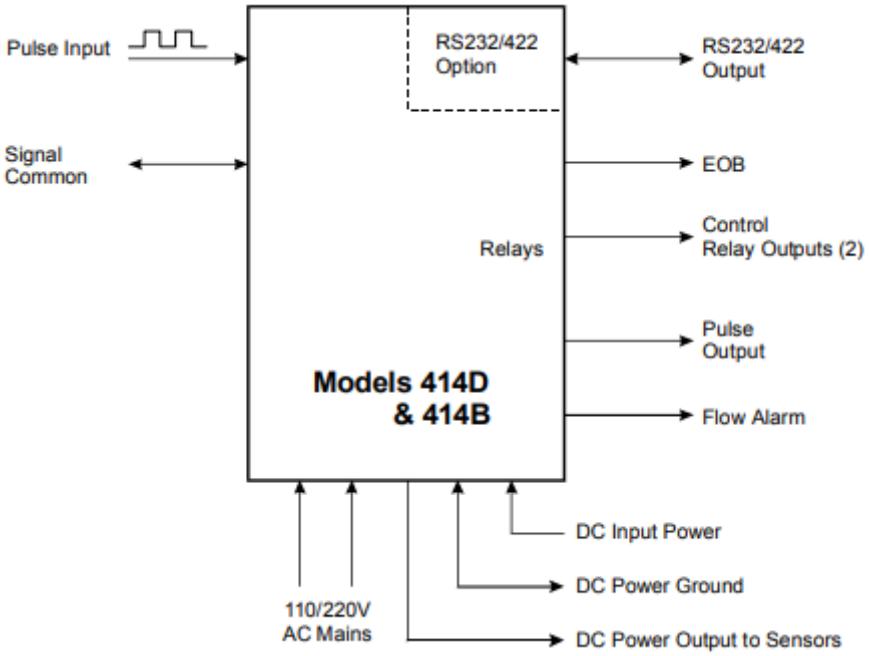


Figure 3: 414 Controller Function Block Diagram

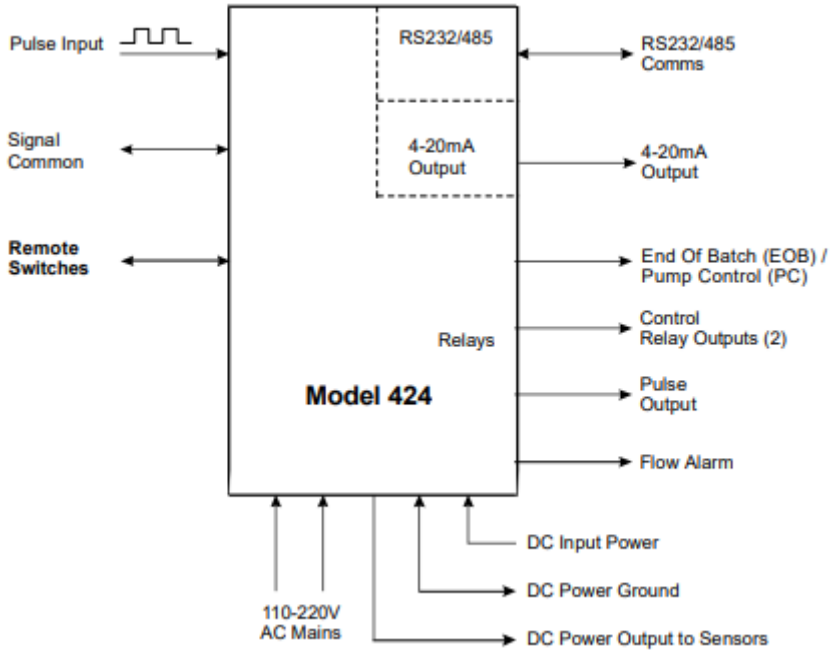


Figure 4: 424 Controller Function Block Diagram

3.1 Front Panel Layout and Key Functions

The Models **414** and **424** Batch Controllers use a simple **four-key front panel interface** to configure, start, stop, and monitor batching operations. Both controllers use the same basic key layout and logic. The **424** adds a **backlit display** for improved visibility and enhanced menu navigation.

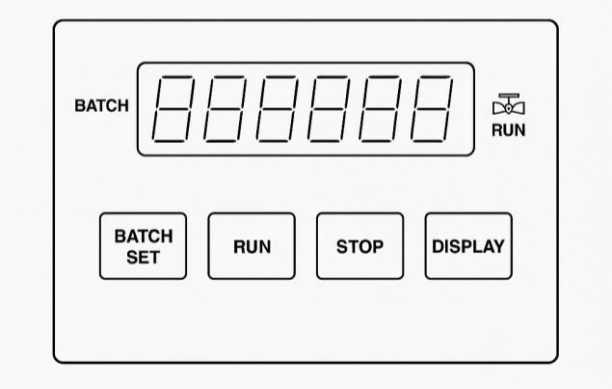


Figure 5: Front Panel Layout

The primary keys are:

- **BATCH SET**: Adjusts and sets the batch quantity.
- **RUN**: Starts or restarts the batch process.
- **STOP**: Stops the batch process or resets the controller when pressed a second time.
- **DISPLAY**: Scrolls between batch total, flow rate, and accumulated total.

The following table describes typical front-panel operations:

Action	Key	Display Response	Notes
Set batch quantity	BATCH SET	Shows “Batch” for 1 s, then current preset quantity (flashing most significant digit)	Press **DISPLAY** to increment the flashing digit. Press **RUN** to move to the next digit. Press **BATCH SET** again to save.
Start batch	RUN	RUN LED illuminates (414), RUN icon appears (424). Batch total begins counting.	If in countdown mode, the display decrements from the preset quantity.
Stop batch	STOP	STOP LED flashes.	Press **STOP** again to reset the batcher.
View flow rate	DISPLAY	Shows “RATE” for 1 s, then the flow rate.	Rate displayed in engineering units programmed in calibration.
View accumulated total	DISPLAY (2nd press)	Shows “ACC” for 1 s, then the non-resettable accumulated total.	Accumulated total cannot be reset during normal operation.
Reset batch total	STOP (at end of batch)	Resets batch total to zero (count-up) or back to preset (count-down).	Auto-reset mode can be enabled in calibration.
Access calibration	STOP + DISPLAY (hold 6 s)	Enters calibration mode.	Front-panel access can be disabled in calibration for security.

Table 9: Front Panel Key Functions

414 vs. 424 Notes:

- **Display:** The 414 uses a standard 6-digit LCD; the 424 adds a backlight for improved readability in low-light environments.
- **Icons/Indicators:** The 424 replaces discrete LEDs with integrated icons on the display (RUN, STOP, valve state, etc.).
- **Navigation:** The 424 features slightly updated menu prompts but maintains the same four-button operation.

The batch quantity can only be set while the instrument is in a non-operational state, such as when the batch is complete or the batch process has been interrupted. However, the **BATCH SET** key can be pressed while in the run state to view the batch quantity. All digits will flash to signal that the quantity cannot be changed.

Starting a Batch

To start the process, press the **RUN** key.

- On the **414**, the **RUN LED** will illuminate.
- On the **424**, the **RUN icon** will appear on the display.

The instrument will begin to totalize from zero or, if programmed for count-down mode, the display will decrement from the batch quantity.

The batch controller has two output relays, which energize and de-energize according to the programmed valve control strategy (see Section 3.2).

Stopping a Batch

The process can be stopped at any time by pressing the **STOP** key. Once the process has been interrupted:

- It can be continued by pressing the **RUN** key again.
- Or aborted by pressing the **STOP** key a second time.

When the process is interrupted, the **STOP LED** (414) or **STOP icon** (424) will flash to prompt the operator to either restart or abort the batch.

Resetting

The instrument can be programmed to reset in one of two ways:

- **Manual Reset**: At the end of a batch, the **STOP** key must be pressed to reset the Batch Total.
    - If programmed for count-down, the total reverts to the preset value.
    - If programmed for count-up, the total clears to zero.
- **Auto Reset**: When enabled, the Batch Total automatically resets when the **RUN** key is pressed to begin the next batch.

Displayed Information

The display normally shows the **Batch Total** (current batch count), which resets on each new batch.

Pressing the **DISPLAY** key cycles through:

- **Rate**: On first press, shows “RATE” for 1 s, then the flow rate.
- **Accumulated Total**: On next press, shows “ACC” for 1 s, then the non-resettable total.

The **Accumulated Total** cannot be reset during normal operation.

Limit on Batch Size

To prevent accidental entry of excessively large batch quantities, a **maximum batch limit** can be programmed during calibration. Operators cannot enter a batch quantity exceeding this value.

NOTE: New in the Contrec 424 is the blacklist 6-digits LCD, integrated RUN/STOP icons to replace discrete LEDS, and expanded menu prompts for easier navigation.

3.2 Batch Operations

The Batch Control functions can be programmed, during Calibration, to operate in one of two ways.

1. At the end of the batch, the STOP key must be pressed to reset the Batch Total. (This must be done before another batch can be started.)

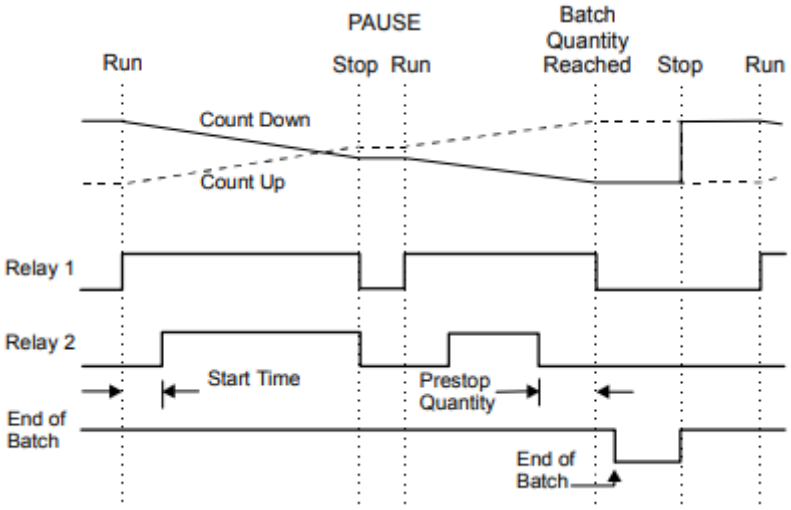


Figure 6: Batch Total Reset

2. If Automatic Reset is programmed, a new batch is commenced each time the RUN key is pressed.

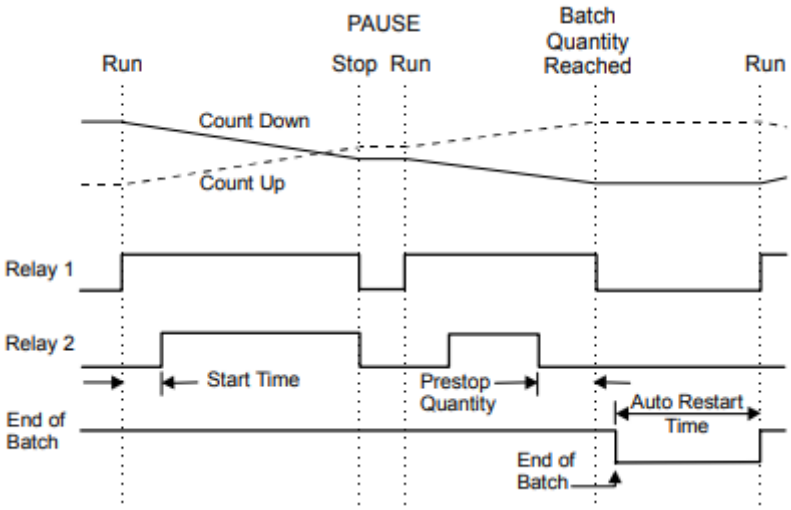


Figure 7: Automatic Reset

The Batch Controller can also be programmed, during Calibration, to either count up from zero on each batch, or to count down from the preset batch quantity.

3.2.1 Control Relay Outputs

The two output relays can be configured to operate in a variety of ways:

- **Single-valve control:** One relay opens and closes the valve for the entire batch.
- **Dual-valve control:** Relay 1 controls a main (fast-fill) valve, while Relay 2 provides a slow-fill (prestop) phase for increased accuracy at the end of the batch.
- **Pump control:** One relay may be dedicated to starting and stopping a pump, while the other controls the valve(s).

The relay operation is illustrated in the timing diagrams in Section 3.2.

A programmable **start delay** allows Relay 2 to energize at a specified time after batching begins, providing a "soft-start" capability. This delay can be set from **0 seconds (no delay)** to **79 minutes and 59 seconds**.

A programmable **prestop quantity** (the quantity from the prestop point to the end of the batch) allows the controller to slow down the fill as the target is approached, enabling precise batching with minimal overrun.

The process can be stopped at any time by pressing the **STOP** key, which immediately de-energizes both relays. The batch can then be:

- **Aborted** by pressing **STOP** a second time, or
- **Resumed** by pressing **RUN**.

If the process is resumed while still in the **slow-start** or **main control** phase (i.e., not in the prestop phase), the start delay timer is re-applied, ensuring a proper startup sequence. In this case, batch totals are not reset, and the batch quantity remains unchanged.

3.2.2 Signal Timeout

The **Signal Timeout** period defines a time interval used to detect when the flow has stopped. If no signal input is detected for a time greater than the Signal Timeout period, the flow is deemed to have stopped.

A **Signal Timeout** period serves two main functions:

- **Mid-Batch Loss Detection:** To detect the loss of signal midway through a batch when the relays are energized. In this case, the batch controller enters a **Flow Alarm** condition and de-energizes the relays.
- **End-of-Batch Overrun Calculation:** After the preset batch quantity has been reached and the relays are de-energized, the Signal Timeout can be used to determine when flow has fully ceased (e.g., accounting for valve closure delays or overrun), thereby improving batch accuracy.

It is recommended that Signal Timeout periods be kept relatively short, but long enough to ensure the period is significantly greater than the time between successive input pulses at the minimum flow rate of the system.

The instrument allows the user to program a timeout of **0 to 99 seconds**.

NOTE: If the Signal Timeout is set to 0, this function is disabled.

Flow Alarm

If the Signal Timeout is set greater than zero and a loss of signal is detected mid-batch, a **Flow Alarm** condition is triggered:

- Both relays de-energize.
- The alarm remains active until acknowledged by pressing the **STOP** key.
- The alarm is also signaled to the operator by the flashing **STOP LED** (414) or **STOP icon** (424).

Once acknowledged, the process can be reset via the **STOP** key or continued by pressing the **RUN** key.

On the **Model 414D**, an **open-collector output on terminal 7** also switches “ON” whenever a Flow Alarm condition exists (see Section 3.5). On the **Model 424**, this function is also available but may be assigned to a configurable output terminal.

3.2.3 End of Batch

An **End of Batch** condition is defined as occurring when:

- The **Batch Quantity** has been reached,
- Flow has stopped, and
- The **Signal Timeout** period has expired.

If the **Signal Timeout** is set to zero, the **End of Batch** is defined as when the Batch Quantity is reached, regardless of whether flow has fully stopped.

The batch controller cannot be reset or restarted until the End of Batch has been determined. Similarly, for RS232/422/485 interfaces, no data will be output until this condition is met.

NOTE: It is strongly advised to keep the Signal Timeout period relatively short to avoid unnecessary delays in confirming End of Batch.

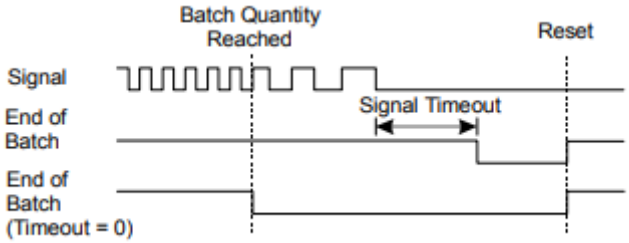


Figure 8: Signal Timeout

End of Batch Signal

An **End of Batch** signal is provided via an **open-collector transistor output**:

- **414:** Output is on **terminal 30** if this terminal has been configured as the End of Batch signal.
- **424:** The End of Batch signal can be assigned to one of the configurable open-collector outputs.

When the End of Batch condition is reached, the output transistor switches **ON** and remains in that state until the instrument is reset.

3.2.4 Auto Restart

The batch controller can be programmed to **automatically repeat the batch process**. This mode of operation is selected during the calibration/programming procedure.

The process begins when the **RUN** key is pressed. After reaching **End of Batch** (see Section 3.2.3), the controller waits for a **pre-programmed delay period** before automatically resetting and starting the next batch.

The **STOP** button may be pressed at any time to pause the batching process. Operation can then be resumed by pressing the **RUN** key.

If the process needs to be aborted entirely, the **STOP** key must be pressed a second time. To restart the auto-batching process, press **RUN** again.

3.2.5 Automatic Overrun Compensation

The batch controller can be programmed to **automatically compensate for overrun** at the end of a batch.

Overrun typically occurs due to valve closure delays or pump inertia after the stop signal is given, resulting in the batch total exceeding the preset quantity.

Automatic Overrun Compensation can be enabled or disabled in the calibration menu. This feature should only be used if the overrun is consistent and repeatable.

CAUTION: Avoid enabling this feature if the overrun is erratic (e.g., caused by varying back pressures, fluctuating pump speeds, or sticking valves), as inaccurate compensation may result.

Calculation Method

- The controller measures the overrun as the **difference between the batch setpoint and the actual batch total** after flow stops.
- It uses the **average overrun from the last three completed batches** to calculate a correction value.
- This average is then subtracted from the next batch's preset, reducing the effect of overrun and improving overall accuracy.

Requirements for Use

For Automatic Overrun Compensation to function:

- The **Signal Timeout** must be set to a **value greater than zero** (see Section 3.2.2).
- This allows the controller to detect when flow has fully stopped and properly measure the overrun amount.

3.3 Calculation of Rate and Total

3.3.1 Frequency Input

The flowrate, **R**, is calculated using the following equation:

$$R = \frac{f \times H}{S}$$

Equation 1: Rate and Total Calculation

Where:

- f = input frequency in Hz
- H = time base of rate:
  - 1 for seconds
  - 60 for minutes
  - 3,600 for hours
  - 86,400 for days
- S = Scaling Factor

The **Scaling Factor (S)** corresponds to the **K-factor** of the flowmeter, expressed in pulses per unit volume.

During calibration, the user:

- Programs the **Scaling Factor** based on the flowmeter's K-factor, and
- Selects the **time base** (seconds, minutes, hours, or days) for rate display.

This setup ensures accurate conversion of incoming pulse signals to engineering units for both flowrate and totalized volume.

3.3.2 Filtering

Flowrate readings from a flowmeter can be affected by pulsations in the flow, making the displayed rate difficult to interpret with accuracy. To address this, the batch controller includes a **digital filter** that averages incoming signal fluctuations, enabling stable readings with up to four-digit precision.

The ability to select a suitable filtering level allows users to balance display stability and response time, ensuring accurate and readable flowrate information without introducing excessive lag.

The diagram below illustrates the effect of filtering on a pulsating input signal:

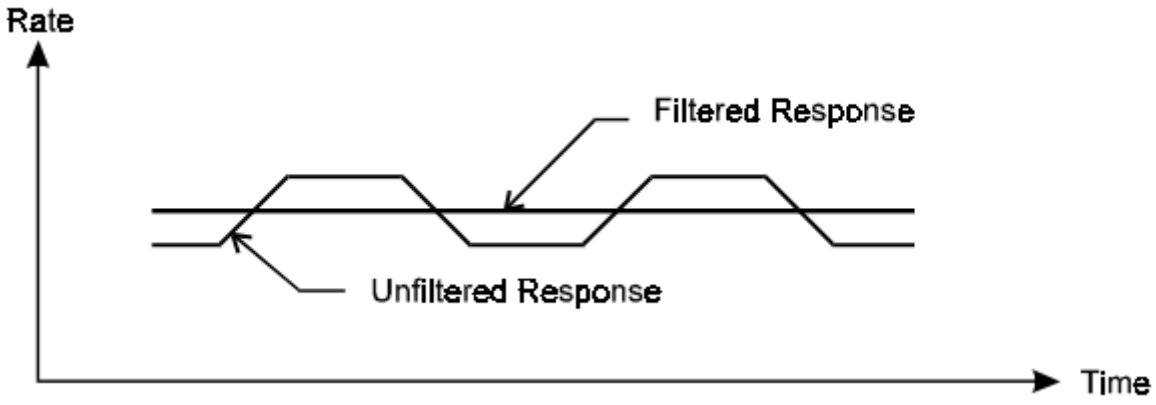


Figure 9: Filtering

Filter Constant (A)

Filtering is configured using a **filter constant (A)**, which is programmed during the calibration routine.

- **Lower values of A (e.g., 1–6):** Faster response, minimal filtering.
- **Higher values of A (e.g., 60–99):** Greater smoothing, slower response.

When **A = 1**, no filtering is applied.

The table below shows the approximate time in seconds for the displayed value to reach **90%** and **99%** of a step change in input, for various values of A:

A	90% (s)	99% (s)
1	0	0
2	1	2
4	2	4
6	3	6
10	5	11
15	8	17
20	11	22
25	14	28
35	20	40
45	25	51

A	90% (s)	99% (s)
60	34	69
75	43	86
90	52	103
99	57	113

Table 10: Response to a Step Input

NOTE: Values are approximate. Actual performance may vary based on system conditions.

3.4 Total Conversion

The Total Conversion feature allows the flow rate to be displayed in one engineering unit (e.g., gallons per minute) while the totals (Batch Total, Accumulated Total, and Gross Total) are displayed in a different engineering unit (e.g., barrels).

The Scaling Factor is always programmed in the units relating to Rate, while the Total Conversion Constant (TOTCON) is a division factor used to convert the totals into the desired engineering unit. This conversion affects all totalized values, including the Batch Quantity, Batch Total, and Accumulated Total.

The Total Conversion constant can be programmed between 0.01 and 2000.

Example

If the **rate** is required in **gallons per minute**:

1. Program the **Scaling Factor** as pulses per gallon.
2. Program the **time base** as minutes.

If the **totals** are required in **barrels**:

3. Program the **Total Conversion Constant** as **42** (there are 42 gallons in one barrel).

All totals will now be displayed in **barrels** while the rate remains in **gallons per minute**.

Rate*	**Totals**	**TOTCON**
Gallons (US)	Barrels (oil)	42.000
Liters	Kiloliters	1000
mL	Liters	1000
MGallons	Acre-feet	0.32587

Table 11: Common Units and Conversion Factors

NOTE: Units per second, minute, hour, or day. The timebase is programmed separately during calibration.

3.5 The Output Pulse and Flow Alarm (Models 414D and 424 Only)

Output Pulse

An **OUTPUT PULSE** is available for driving remote counters and external devices.

- **414D:** Available on **terminal 10**.
- **424:** Available on a **configurable open-collector output** (see wiring tables in Section 2.8.2).

This output produces one pulse each time the **Accumulated Total** increments by one digit. For example, if the Accumulated Total resolution is 0.01 litres, a pulse is produced for each 0.01 litres measured.

Pulse Specifications:

- **Type:** Current-sinking pulse via open-collector transistor
- **Duration:** Approximately 10 ms
- **Maximum Pulse Rate:** 49 pulses per second
- **Load:** Compatible with most counter inputs (external pull-up required)

Flow Alarm

The **FLOW ALARM** output uses the same circuit as the Output Pulse:

- **414D:** Available on **terminal 7**.
- **424:** Available on a **configurable open-collector output**.

The Flow Alarm output is triggered if no flow is detected for a time greater than the **Signal Timeout** period (see Section 3.2.2).

Behavior:

- The Flow Alarm switches **"ON"** (signal goes low) whenever an alarm condition exists.
- The Flow Alarm switches **"OFF"** (signal goes high) when the alarm is acknowledged by pressing the **STOP** key.

NOTE: The 424 provides **additional flexibility** in assigning outputs, allowing the Pulse Output and Flow Alarm to be mapped to any available open-collector output terminal.

Connection of Output Pulse and Flow Alarm are as follows:

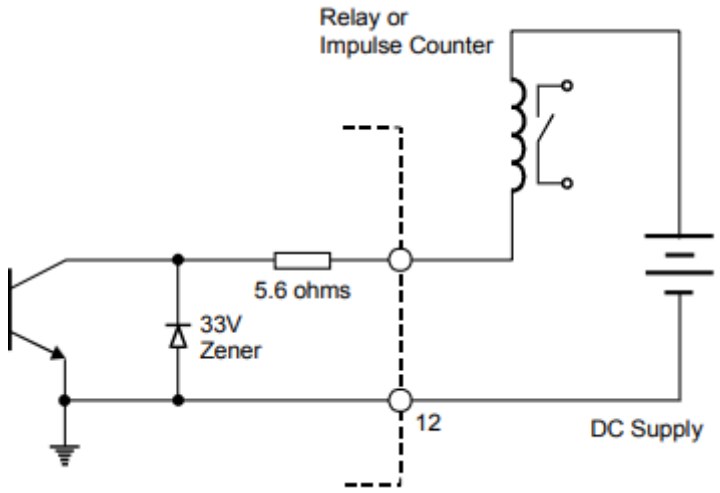


Figure 10: Driving an External Relay or Impulse Counter

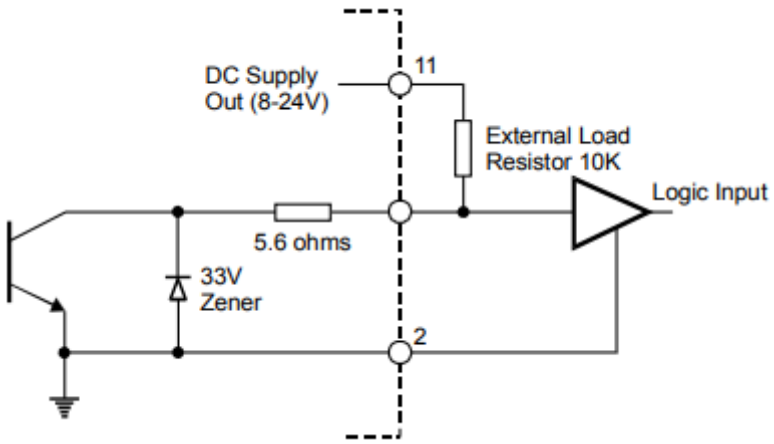


Figure 11: Driving a Logic Input such as a PLC or Electronic Counter

4 Options and Communication

4.1 Serial Communication Interfaces (RS-232 / RS-485)

Model 414

For the 414 controller, the RS232 and RS422/485 communication circuits are available **only when the interface option is installed**. These interfaces can be used to connect the instrument to printers or host computers. A number of standard ASCII-based protocols are built into the instrument for data reporting and control.

Model 424

For the 424 controller, **RS232 and RS485 interfaces are provided as standard** (no option card required). These interfaces support printer connections, multi-drop networks, and host computer integration.

The 424 also simplifies configuration with **menu-driven setup** for baud rate, parity, data bits, and addressing, making communication setup faster and less error-prone.

4.1.1 Hardware

Model 414

The RS232, RS422, and RS485 communication interfaces are available **only when the communication option is installed**. All three interfaces are accessible via the rear terminal strip, and the user selects which interface to use by making the appropriate wiring connections.

Model 424

The RS232 and RS485 interfaces are **standard features** (no additional option card required). These are available on the rear terminal strip and can be configured via the instrument's menu for use with printers, host computers, or multi-drop networks.

Interface Usage

- **RS232:** Primarily used for printers or simple point-to-point communication with a host computer over a short distance.
- **RS422/RS485:** Used for longer-distance communication or in multipoint networks.

Wiring

The following diagram provides an overview of the communication hardware and connections:

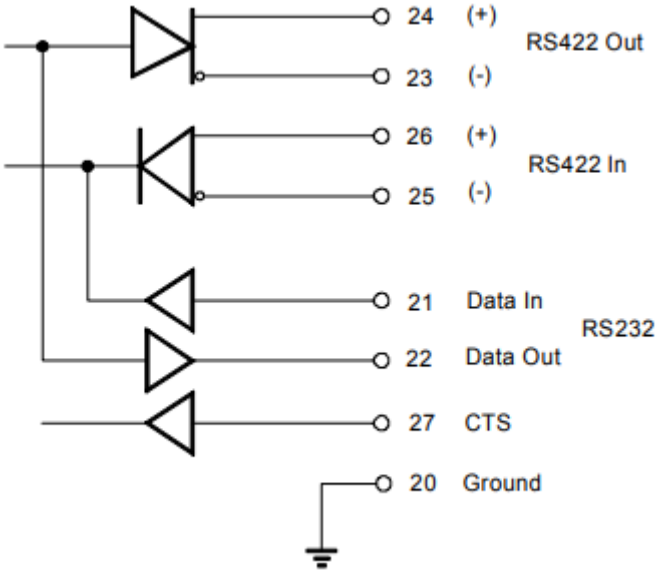


Figure 12: Wiring DIagram

Note for the 424:
Terminal numbering differs from the 414. On the 424:

- RS232: Terminals **25 (TX)**, **26 (RX)**, **27 (GND)**
- RS485: Terminals **28 (A)** and **29 (B)**

For complete terminal assignments, see Section 2.8 (Terminal Designations).

4.1.2 Multipoint Communication

Multipoint Communication allows multiple instruments to be addressed over a **dual twisted-pair interface**. Up to **32 instruments** can share a common bus using the **RS485 interface**, enabling networked communication with a single master controller.

To convert an **RS422 interface** to an **RS485** configuration (on the 414):

- Connect RS422 (−) Data In to RS422 (−) Data Out.
- Connect RS422 (+) Data In to RS422 (+) Data Out.

These connections convert the 4-wire RS422 interface into the 2-wire RS485 interface (see Figure 14).

Each instrument can be programmed with a **unique address**. The master controller (e.g., PLC, PC, or SCADA system) uses this address to communicate with individual instruments on the bus.

The controller sends the address down the line, alerting the relevant instrument, after which subsequent software protocols manage the data flow between the controller and the instrument.

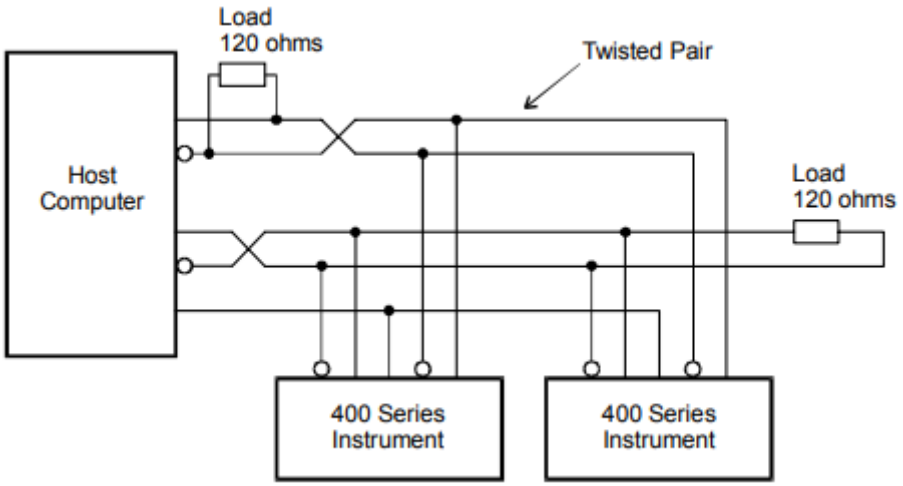


Figure 13: RS422 Interface

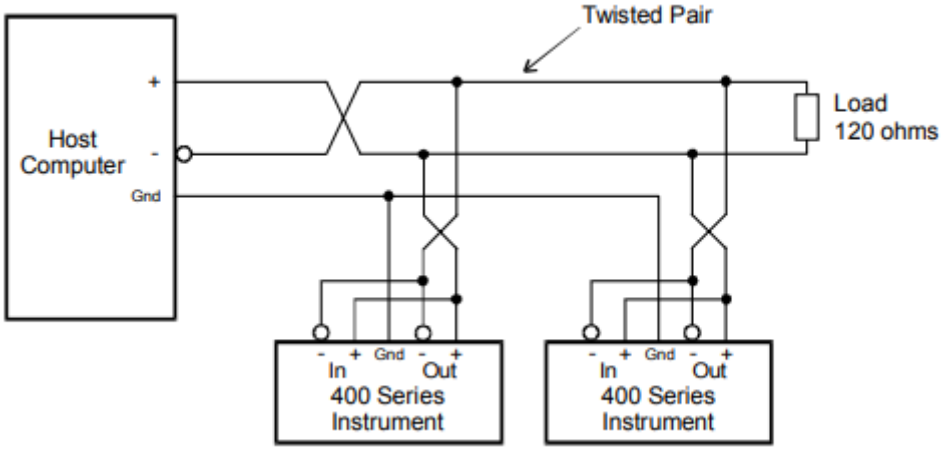


Figure 14: RS485 Interface

4.1.3 Printer and Computer Connections

Clock and Ticket Printing

Both the 414 and 424 controllers include a **real-time clock** for printing the time and date on batch tickets.

- **Date formats:** European (DD/MM/YYYY) or U.S. (MM/DD/YYYY)
- **Time format:** 24-hour clock

NOTE: On the 414, the clock retains time for a minimum of **3 days** without power. After this, the clock may need to be reset. The 424 retains clock data longer due to improved internal backup.

Baud Rate and Serial Settings

Baud rate, parity, word length, and other communication parameters are configured during calibration. These must match the connected device (printer or computer).

Protocols

The controllers provide **standard ASCII protocols** for integration with printers and host systems. On the 424, protocol selection and addressing are menu-driven for easier configuration.

Printer Support

A ticket can be printed automatically at the completion of each batch. Supported printers include:

1. Standard RS232 Computer Printer
2. EPSON CTM290 Slip Printer
3. Contrec Model 624
4. EPSON TM290-2 Slip Printer
5. Contrec Model 632-2
6. Syntest SP-210

Tickets can include various units (liters, gallons, etc.), selected from a pre-programmed list.

CTS Input:
A CTS input prevents the controller from sending data when the printer buffer is full. If the printer can handle the entire data output without interruption, this input may remain unconnected.

Computer Interface

Messages are transmitted and received in **ASCII format**:

- All **commands to the instrument** end with a **carriage return**.
- All **replies from the instrument** end with a **carriage return and line feed**.

The **Xon/Xoff protocol** is supported on the RS232 interface for software flow control:

- The instrument automatically switches to Xon/Xoff if an Xoff character is detected at the start of a command.
- Commands are wrapped in Xoff/Xon characters to maintain synchronization.

Duplex Modes

The instrument can operate in **full-duplex** or **half-duplex** modes:

- **Full duplex:** All commands sent to the instrument are echoed back to the host.
- **Half duplex:** Commands are not echoed.

5 Calibration and Programming

The Calibration routine allows users to configure all setup parameters and check input signals for correct operation.

Entering Calibration

Calibration can be entered in two ways:

1. **Terminal Link:**
   Connect a wire link (or switch) across **terminals 1 and 2** on the rear terminal strip.
2. **Front-Panel Key Combination:**
   Press and hold the **STOP** key, then press and hold the **DISPLAY** key for approximately **6 seconds**.

NOTE: This method of access can be disabled during calibration, forcing calibration access to be performed only via the rear-terminal link.

Key Functions in Calibration

- **RUN:** Advances to the next flashing digit.
- **DISPLAY:** Increments a flashing digit or changes a parameter selection.
- **BATCH SET:** Resets a flashing digit to zero.
- **STOP:** Steps through the program sequences.

The **arrows** on the RUN and DISPLAY keys indicate their roles for navigating digits (RUN) and incrementing values (DISPLAY).

Program Navigation

When stepping through the calibration program:

- The **Parameter Description** is shown first.
- This is followed by the actual value or parameter.
- Editable parameters flash, and the corresponding key LEDs illuminate to indicate that a change can be made.

Calibration Modes

On entering Calibration, the display will show:

- **CAL** – Setup Program Parameters (see Section 5.1)
- **Batch** – Batch Parameters (see Section 5.2)
- **Option** – Option Parameters (if installed) (see Section 5.3)
- **Test** – Input Signal Check (see Section 5.4)
- **End** – Exit Calibration and return to normal operation

Use the **DISPLAY** key to toggle between modes. Use the **STOP** key to select a mode.

Exiting Calibration

To exit, step through the program until **End** is displayed. Press the **STOP** key to return to normal operation.

Ensure the calibration link is removed if using the rear-terminal method.

5.1 Entering Calibration Mode

This section describes how to configure the setup parameters in **CAL** mode.

Step	Display	Description	Text Ref
1	**CAL**	Select the **Calibrate** mode to set up program parameters.	–
	BATCH	Enter Batch Setup parameters.	5.2
	OPTION	Configure optional features (if installed).	5.3
	TEST	Check input signals.	5.4
	END	Exit Calibration and return to normal operation.	–
2	**RESTOT**	Reset all totals (resettable and accumulated). Press **BATCH SET** to confirm reset.	–
3	**SCALE**	Enter the **Scaling Factor (K-factor)** of the flowmeter.	3.3.1
4	**F dPt**	Number of decimal points for the **Rate** display (0 to 0.00000).	–
5	**t.base**	Select the **Timebase** for the Rate: **60secs** = units/min **hours** = units/hour **days** = units/day **secs** = units/second	–
6	**FILTER**	Set the **filter constant** for the rate display. **1** = No filtering **99** = Very heavy filtering.	3.3.2
7	**TOTCON**	Set the **Total Conversion Constant** for displaying totals in units different from the rate (e.g., gallons/min and barrels). **1** = Rate and totals use same units. Other values: 0.01 to 2000.	3.4
8	**t.dPt**	Number of decimal points for the **resettable total** (0 to 0.000).	–
9	**A.dPt**	Number of decimal points for the **accumulated total** (0 to 0.000).	–
10	**ACCESS**	Enable or disable **front-panel access** to Calibration: **Front** = Access via keyboard enabled. **No Acc** = Front access disabled (rear-terminal link only).	–

5.2 Entering the Batch Parameters

This section describes the **BATCH** mode parameters used to configure batching operation.

Step	Display	Description	Text Ref
1	**BATCH**	Enter Batch Parameters.	–
	OPTION	Configure optional features (if installed).	5.3
	TEST	Check input signals.	5.4
	END	Exit Calibration.	–
	CAL	Return to Setup Parameters.	5.1
2	**BATCH L**	Maximum Batch Size allowed. **Set to 0** if no limit is required.	3.2
3	**AUTO S**	**Automatic Restart** feature: **Off** = Disabled **On** = Enabled. If enabled, restarts the batch after **xx:xx** (min:sec) delay.	3.2.4
4	**START.T**	**Slow Start Delay:** Time (min:sec) before Relay 2 energizes after batch start.	3.2
5	**PREST**	**Prestop Quantity:** Amount remaining when Relay 2 de-energizes near batch end.	3.2
6	**COUNT**	**Batch Total Mode: dn** = Count down from preset **up** = Count up from zero.	3.2
7	**T OUT**	**Signal Timeout:** Timeout in seconds for flow detection. **0 disables** this feature.	3.2.2
8	**AOC**	**Automatic Overrun Compensation: En** = Enabled **Dis** = Disabled. Note: Signal Timeout must be greater than 0.	3.2.5
9	**AUTO R**	**Auto Reset:** (Not displayed if Auto Restart is enabled) **Off** = Manual reset required. **On** = Automatically resets and starts batch when **RUN** is pressed.	3.2

5.3 Batch Parameter Settings

This section describes the **OPTION** mode parameters, used for configuring date/time settings, communication protocols, and printer/computer options.

Step	Display	Description	Text Ref
1	**OP-TIONS**	Enter Programming Options.	–
	TEST	Check Input Signals.	5.4
	END	Exit Calibration.	–
	CAL	Return to Setup Parameters.	5.1
	BATCH	Enter Batch Parameters.	5.2
2	**DF**	**Date Format: Eur** = European (DD/MM/YYYY) **USA** = U.S. (MM/DD/YYYY).	4.1
3	**Date**	Set Date (YYYY:MM:DD).	4.1
4	**HOUR**	Set Time (HH:MM, 24-hour).	4.1
5	**BAUD**	**Baudrate:** 300, 600, 1200, 2400, 4800, 9600.	–
6	**DATA**	**Word Length:** 7 or 8 bits.	–
7	**PARITY**	**Parity: NP** = None **OP** = Odd **EP** = Even.	–
8	**SIGNAL**	**Signal Type: rs232** = RS232 **rs422** = RS422/RS485.	–
9	**ID NO**	**Unit Identification Number:** 0 (none) to 99.	–
10	**P TYPE**	**Printer/Computer Type:** 00 = Standard Computer Printer 01 = EPSON CTM 290 Slip Printer 02 = Contrec Model 624 Printer 03 = EPSON TM290-2 Slip Printer 04 = Contrec Model 632-2 Printer 05 = Syntest SP-210 Printer 20 = Computer.	–

If a **Printer Protocol** is selected:

Step	Display	Description
10	**UNIT**	**Units of Measurement Printed:** 00 = None 01 = Litres 02 = Gallons 03 = Barrels 04 = Pounds 05 = Grams 06 = Kilograms 07 = Tons.

If a **Computer Protocol** is selected:

Step	Display	Description
10	**ECHO**	**Echo Mode:** **On** = Full Duplex (echo enabled) **Off** = Half Duplex (echo disabled).

5.4 Programming Communication Options

This section describes the **TEST** mode parameters used for diagnostics and verification of inputs.

Step	Display	Description	Text Ref
1	**TEST**	Enter Test Mode to check input signals.	–
	OP-TIONS	Enter Programming Options.	5.3
	CAL	Return to Setup Parameters.	5.1
	BATCH	Enter Batch Parameters.	5.2
	END	Exit Calibration.	–
2	**Sr.x.xx**	Displays the **software revision number** of the instrument.	–
3	**Freq**	Displays the **input frequency** in Hz. The value is displayed for 1 second, followed by the actual measured frequency.	–

Step	Display	Description	Text Ref
4	CLOC	(If RS232/422/485 option is installed): Displays the **real-time clock** in HH:MM:SS format.	–

6 Input & Output Connections

This section covers the connection of flowmeter signals for:

- **Model 414D:** Batch Controller with an input signal conditioning card.
- **Model 414B:** Batch Controller with basic signal input capability.
- **Model 424:** Batch Controller with enhanced universal signal input capability (supports pulse, open collector, and contact closure inputs with improved noise immunity).

Regulated Sensor Supply

All models provide a **regulated output** for powering external sensors:

- **Adjustable Voltage Range:** 8–24 V (adjusted via rear-panel trimpot).
- **Maximum Current Output:** 50 mA.

This allows the batch controller to directly power many flow sensors without requiring an external power supply.

6.1 Input Circuit for the Model 414D

The **Model 414D** includes an **input conditioning card** that accepts signals from most pulse- or frequency-producing flowmeters.

An **8-position DIL switch** on the rear panel allows the input circuit to be configured for various signal types.

The input circuit will interface directly with:

- Turbine flowmeters
- Open-collector outputs
- Reed switches
- Logic signals
- Two-wire proximity switches

The following pages provide interconnection examples for various signal sources, as well as a circuit diagram of the input stage.

Switch Settings

The table below provides the recommended DIP switch settings for different input signal types:

Input Signal Type	Input Terminals	Switch Settings (1–8)
a. Logic Signal, CMOS, Pulse	9 (+), 8 (–)	off / off / off / on / off / off / on / off
b. Open Collector or Reed Switch	9 (+), 8 (–)	off / off / off / on / off / off / on / off
c. Namur Proximity (DC out to 8 V)	11 (+), 9 (–)	off / on / on / off / on / off / off / off
d. Switch or Reed Switch with de-bounce circuit (200 Hz max)	9 (+), 8 (–)	off / off / off / on / off / off / on / on
e. Coil (20 mV P-P min.)	9 (+), 8 (–)	off / off / off / off / off / off / off / off
f. Coil (low-impedance, 22 mV P-P min.)	9 (+), 8 (–)	on / on / off / off / off / off / off / off

Table 12: DIP Switch Settings

General Specifications

- **Switching Threshold:** 2.5 V (except for input types c, e, f)
- **Maximum Input Voltage:** 50 V peak
- **Input Impedance:**
    - Type a: 100 kΩ
    - Types b & d: 10 kΩ
    - Type c: 1 kΩ
    - Type e: 100 kΩ
    - Type f: 2.4 kΩ

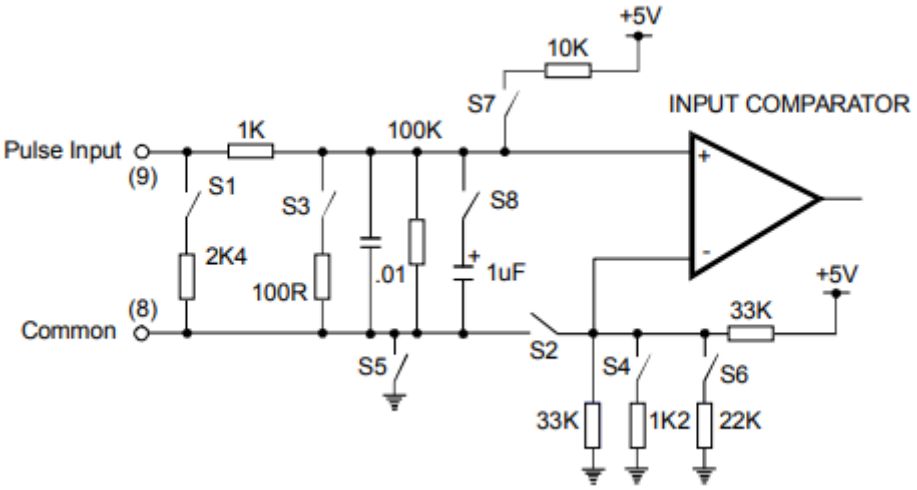


Figure 15: The Frequency Input Circuit

1. Squarewave, CMOS or Pulse

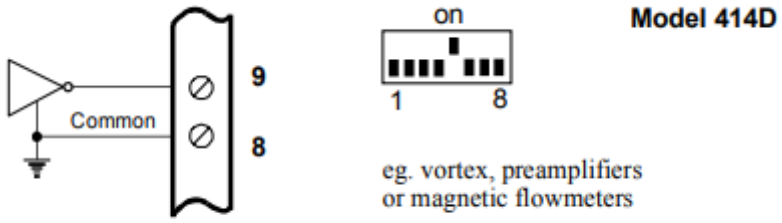


Figure 16: Model 414D Squarewave, CMOS or Pulse Input

2. Open-Collector

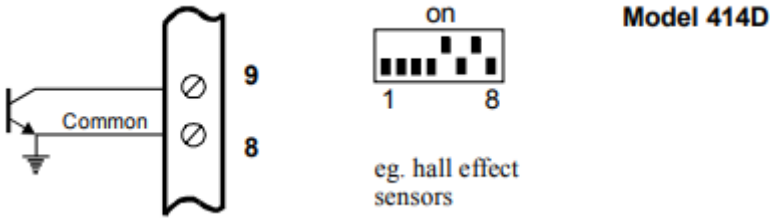


Figure 17: Model 414D Open-Collector Input

3. Reed Switch

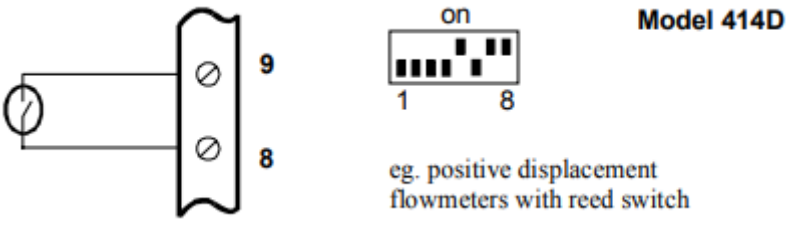


Figure 18: Model 414D Reed Switch Input

4. Coils

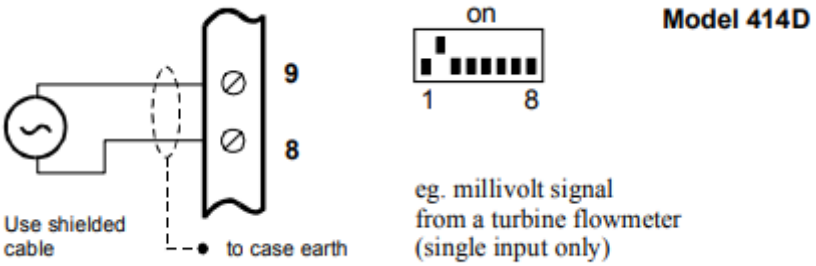


Figure 19: Model 414D Coils Input

5. Namur Proximinity Switch

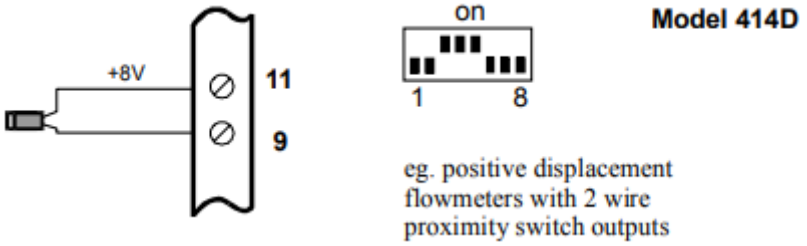


Figure 20: Model 414D Namur Proximity Swtich Input

6. Opto-Sensors

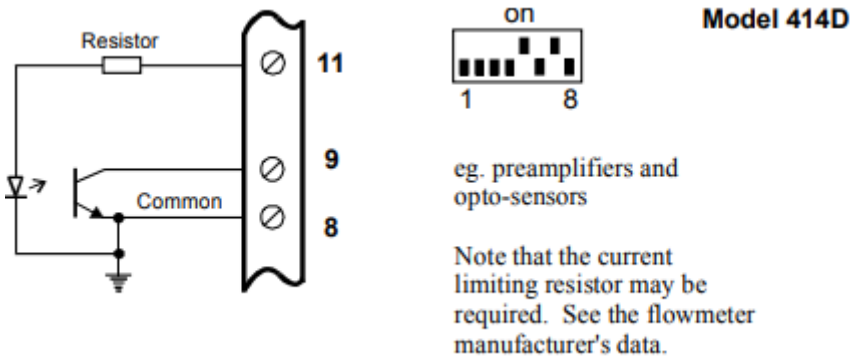


Figure 21: Model 414D Opto-Sensors Input

6.2 Input Circuit for the Model 414B

The **Model 414B** accepts **basic squarewave, pulse, or open-collector output signals**.

- It does **not** support low-level mV coil signals or two-wire proximity switch outputs.
- Input filtering is limited, and signal levels must stay within the specified thresholds for reliable operation.

For **open-collector outputs**, an **internal 10 kΩ pull-up resistor** is provided as a load. Users must ensure that connected devices switch cleanly between the required low and high signal levels.

General Specifications

- **Signal Types:** Squarewave, Pulse, Open Collector
- **Signal Level Requirements:**
  - **Low Level:** < 1.5 V
  - **High Level:** > 3.0 V (must not exceed 30 V)

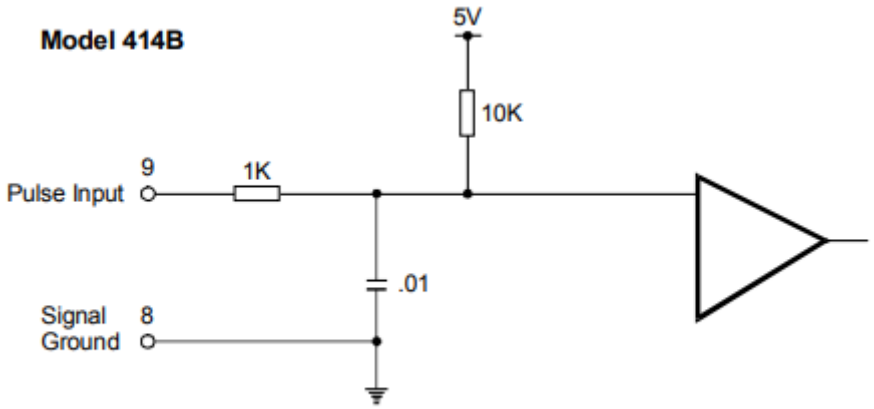


Figure 22: Model 414B Input Circuit

1. Squarewave or Pulse Inputs

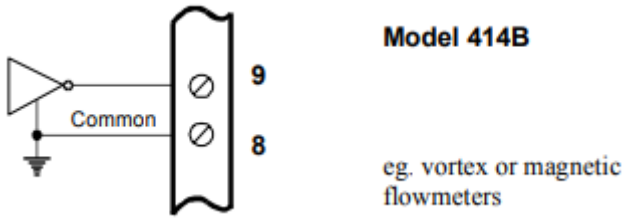


Figure 23: Model 414B Squarewave or Pulse Inputs

2. Open-Collector Inputs

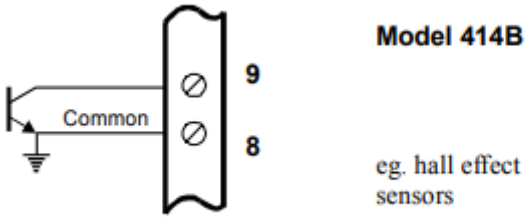


Figure 24: Model 414B Open-Collector Inputs

3. Opto-Sensor

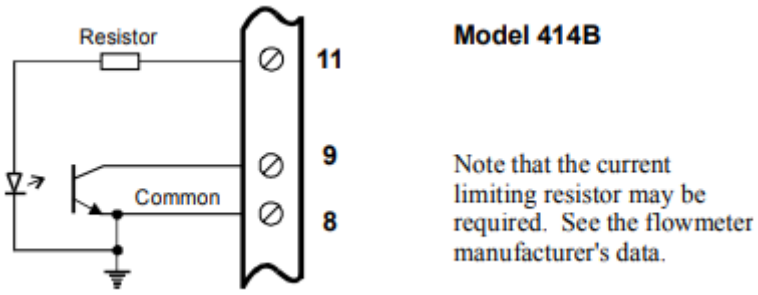


Figure 25: Model 414B Opto-Sensors

4. Reed Switch

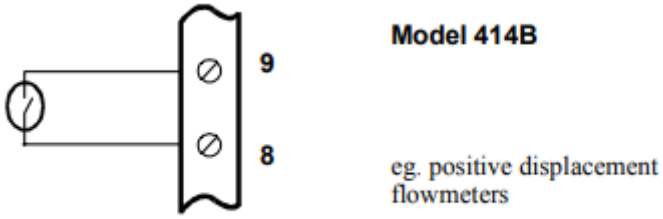


Figure 26: Model 414B Reed Switch

6.3 Input Circuit for the Model 424

The **Model 424** features an **enhanced universal input stage** designed for direct interfacing with most pulse-producing flowmeters without requiring manual hardware configuration (e.g., DIP switches).

Supported Signal Types

The 424 automatically detects and conditions the following input types:

- **Squarewave / Logic signals** (CMOS, TTL, PLC outputs)
- **Open-collector transistor outputs**
- **Mechanical contact closures** (e.g., reed switches)
- **Low-level coil signals** (down to 20 mV p-p)
- **Two-wire NAMUR proximity switches**

General Specifications

- **Frequency Range:** 0.25 Hz to 10 kHz
- **Input Impedance:** 10 kΩ typical (varies by input type)
- **Signal Thresholds:**
  - **Logic High:** > 3 V
  - **Logic Low:** < 1.5 V
- **Maximum Input Voltage:** 50 V peak

- **Coil Sensitivity:** 20 mV p-p (low-level AC)
- **Proximity Power:** Internal sensor power provided via 8–24 V regulated output (50 mA max).

Advantages Over the 414

- **Automatic Signal Detection:** No DIP switch adjustments are required.
- **Improved Noise Immunity:** Advanced filtering and signal conditioning enhance performance in electrically noisy environments.
- **Simplified Setup:** Reduced wiring complexity and fewer manual adjustments.

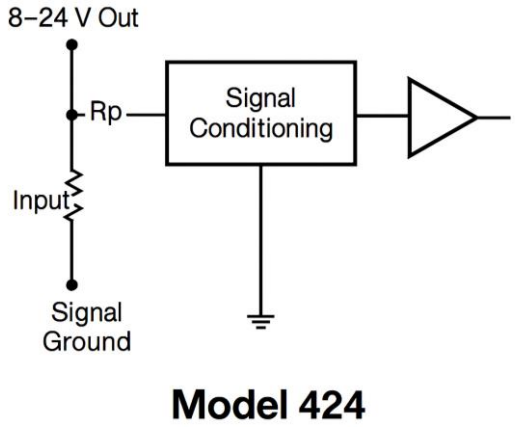


Figure 27: Model 424 Input Circuit

1. Squarewave / Logic Signals (CMOS, TTL, PLC outputs)

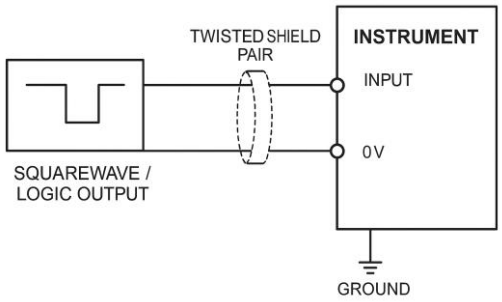


Figure 28: Model 424 Squarewave Input

2. Open-Collector Transistor Outputs

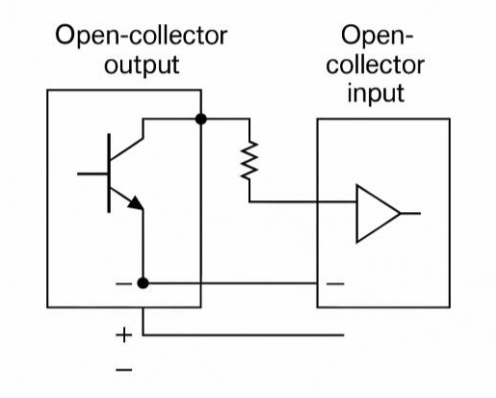


Figure 29: Model 424 Open-Collector Output

3. Mechanical Contact Closures (e.g., reed switches)

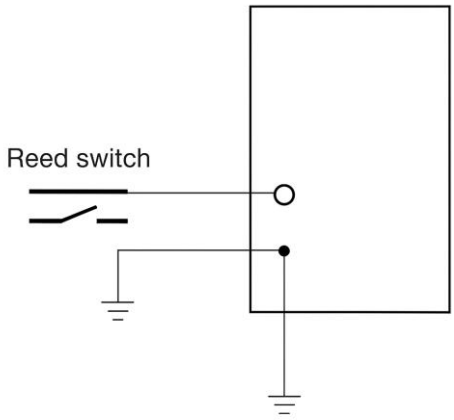


Figure 30: Model 424 Mechanical Relay Input

4. Low-Level Coil Signals (down to 20 mV p-p)

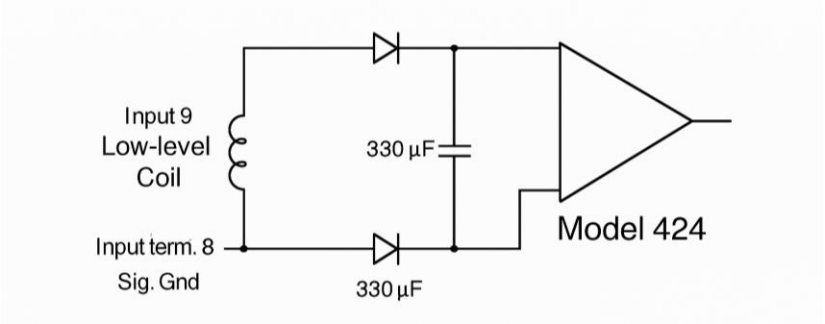


Figure 31: Model 424 Low-Level Coil Input

5. Two-wire NAMUR proximity switches

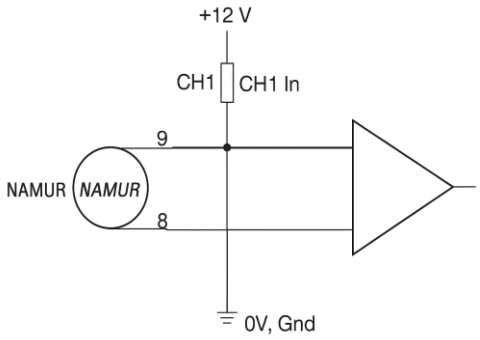


Figure 32: Model 424 Namur Circuit

6.4 Remote Switches (Start/Stop/Batch Set)

Remote push-buttons can be connected to the **414D**, **414B**, and **424** to duplicate the functions of the front-panel keys.

- **Model 414D:** All four switches (**RUN**, **STOP**, **DISPLAY**, **BATCH SET**) are available at the rear terminals.
- **Model 414B:** Only the **RUN** and **STOP** switches are available at the rear terminals.
- **Model 424:** All four switches (**RUN**, **STOP**, **DISPLAY**, **BATCH SET**) are available at the rear terminals, similar to the 414D.

Wiring

Each switch is a **momentary-contact, normally-open** type. Use shielded wiring for long runs to minimize interference.

The typical connections are:

- **RUN** – Terminals 2 & 28
- **STOP** – Terminals 2 & 29
- **DISPLAY** – Terminals 2 & 4 (**414D/424 only**)
- **BATCH SET** – Terminals 2 & 5 (**414D/424 only**)

The switches are wired as follows:

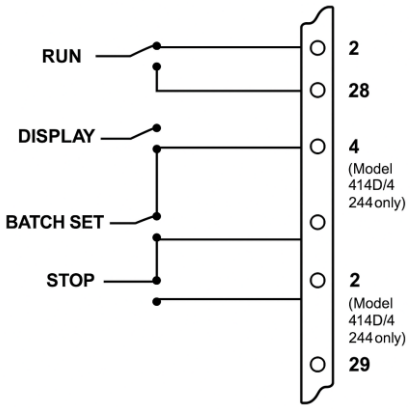


Figure 33: Remote Switch Diagram

7 Installation

7.1 General

his section provides information on terminal designations, installation requirements, and wiring recommendations for the **Model 414D**, **414B**, and **424** Batch Controllers.

Panel Mounting

- **Cutout dimensions:** 5.5” (139 mm) wide × 2.6” (67 mm) high.
- **Mounting:** Secure the instrument in the panel using the two side clips provided.

Case Earthing

An **earthing lug** is located on the side of the case for connection to protective earth.

- This connection is **for the case only** and provides complete electrical isolation from all electronic circuits.
- For **EMC compliance** and safety, when connected to mains, this point **must** be connected to a good earth using a **multi-stranded, braided wire or strap**.
- All **relay outputs** are fully isolated from the case and internal electronics.

Relay Outputs

- The two output relays are **changeover relays** with both “normally open” (NO) and “normally closed” (NC) terminals available.
- Relay outputs are **fully isolated** from the case and internal circuits.

Sensor Power Output

A regulated DC output is provided to power external sensors:

- **Voltage Range:** 8 – 24 V DC (adjustable via rear-panel potentiometer).

- **Factory Setting:** 24 V DC.
- **Current Limit:** 50 mA maximum.
- When powered from DC, the **supply output = DC input voltage − 3.5 V** (approximate).

Power Supply

- Operates from **12 – 28 V DC** or **mains AC**.
- **Factory-set mains ranges:**
    - 95 – 135 V AC (110 V nominal).
    - 190 – 260 V AC (220 V nominal).
- Internal transformer provides isolation between mains and internal circuits.

Common Grounding

Terminal 12 provides a **common ground** for:

- 12 – 28 V power input
- 8 – 24 V sensor supply
- Pulse output
- End-of-batch output

Shielding & EMC

- Use **shielded cables** for all signal connections.
- Keep **signal and power cables separate** to minimize noise.
- Connect all shields to **case earth at the controller** (shortest possible length).
- This wiring practice is **mandatory** to comply with **EMC Directive 89/336/EEC**.

Note: Although shields can be connected to **signal ground (terminal 2)**, this is **not EMC-compliant**.

RC Networks for Inductive Loads

When switching highly inductive loads with the relay outputs, **RC suppression networks ("snubbers")** are strongly recommended:

- **Purpose:**
    - Minimize arcing across relay contacts, reducing electrical noise and avoiding microprocessor disturbances.
    - Extend relay life by preventing premature wear due to pitting.
- **Typical Values:**
    - **Capacitor:** 0.25 µF.
    - **Resistor:** 100 Ω.

- Use only **mains-approved RC networks**.

7.2 Field Wiring Guidelines (Shielding and Grounding)

The following table lists terminal assignments for the **414D**, **414B**, and **424** Batch Controllers.

Terminal	Model 414D	Model 414B	Model 424
1	Calibration Link	Calibration Link	Calibration Link
2	Signal Ground	Signal Ground	Signal Ground
3	Not Used	Not Used	Not Used
4	Remote Display Switch	Not Used	Remote Display Switch
5	Remote Batch Set Switch	Not Used	Remote Batch Set Switch
6	Not Used	Not Used	Not Used
7	Flow Alarm	Not Used	Flow Alarm
8	Flow Common (–)	Flow Common (–)	Flow Common (–)
9	Flow Pulse Input	Flow Pulse Input	Flow Pulse Input
10	Pulse Output	Not Used	Pulse Output
11	DC Power Out (8-24 VDC)	DC Power Out (8-24 VDC)	DC Power Out (8-24 VDC)
12	DC Ground	DC Ground	DC Ground
13	DC Power Input	DC Power Input	DC Power Input
14	Not Used	Not Used	Not Used

Table 13: Power and Signal Connections

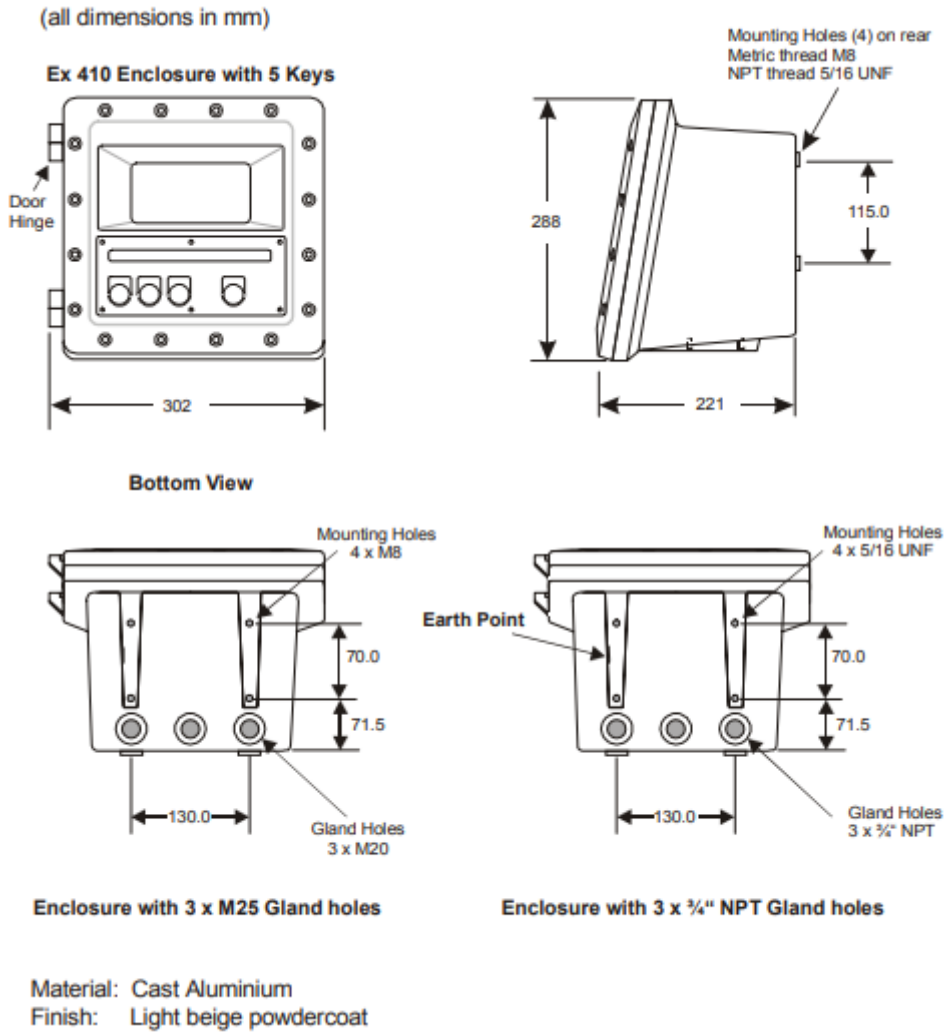
Terminal	Function
20	RS232 Signal Ground
21	RS232 Data In
22	RS232 Data Out
23	RS422/485 (–) Data Out
24	RS422/485 (+) Data Out
25	RS422/485 (–) Data In
26	RS422/485 (+) Data In
27	RS232 CTS

Table 14: RS232/RS422/RS485 Communication Option

Terminal	Function
28	Remote RUN Switch
29	Remote STOP Switch
30	End of Batch / Pump Control Signal
31	Relay 2 – Normally Open
32	Relay 2 – Normally Closed
33	Relay 2 – Common
34	Relay 1 – Normally Open
35	Relay 1 – Normally Closed
36	Relay 1 – Common

Table 15: Relay Outputs & Remote Switches

7.3 EX 410 Enclosure Dimensions



Enclosure with 3 x M25 Gland holes

Enclosure with 3 x ¾" NPT Gland holes

Material: Cast Aluminium
Finish: Light beige powdercoat

8 Troubleshooting

The following guide covers common faults for **Models 414D, 414B, and 424**. Where features are **specific to the 424**, this is noted.

Batcher does not reset

- **Cause:** The Signal Timeout is set to an excessively long period, preventing timeout after the last batch.
- **Action:** Reduce the Signal Timeout (Section 3.2.2).

Batch will not start or Relay 1 will not close

- **Cause:**
  - The instrument has timed out due to the Signal Timeout.
  - A Flow Alarm condition is active.
- **Action:**

- Press the **STOP** key to clear the Flow Alarm.
- Check for a fault on the flow input.
- For the **424**, verify that all programmed digital inputs (if used) are in a valid state before restart.

Batcher stops midway through a batch

- **Cause:** The Signal Timeout has expired during operation.
- **Action:**
  - Check the flow signal for intermittent loss.
  - Ensure the Signal Timeout is set longer than the minimum pulse interval at the lowest expected flowrate.

No display

- **Cause:** No power to the instrument.
- **Action:** Check power connections and supply voltage.

All 88888888 displayed

- **Cause:** On power-up, all digits illuminate for 4 seconds as a display test. If they remain:
  - Power supply voltage is too low.
- **Action:** Verify input power voltage is within the correct range.

Not counting

- **Cause:**
  - Incorrect or loose connections.
  - Incorrect DIL switch settings (**414D only**).
  - Improper input type selection.
- **Action:**
  - Check wiring and verify input configuration (Section 6).
  - For **424**, ensure the correct input type (e.g., pulse, NAMUR, or open collector) is selected in setup.
  - Manually test by pulsing across the input terminals using a wire link (see Section 6).

Counting erratically

- **Cause:**
  - Incorrect input circuit setting.
  - Lack of proper shielding on input wiring.

- **Action:**
    - Verify configuration matches the flowmeter type.
    - Use shielded signal cables, grounded at the controller only.

Instrument acting erratically

- **Cause:** Severe electrical interference, often from switching highly inductive loads.
- **Action:**
    - Install **RC suppression networks ("snubbers")** across relay contacts (see Section 7).
    - Use shielded and properly routed signal cables.
    - If needed, use an isolating relay to separate the load from the batch controller.

No End-of-Batch, Pulse Output, or Flow Alarm

- **Cause:** Lack of pull-up resistor or load on outputs. Outputs have no internal pull-ups and require an external load.
- **Action:** Add appropriate pull-up/load resistors to outputs as needed.

Additional 424-specific checks

- **Digital Inputs:** Ensure any optional digital inputs (if configured) are in the correct state.
- **Output Conflicts:** Confirm that multiple outputs (e.g., End of Batch and Pulse) are not simultaneously assigned to the same terminal in programming.
- **Communication Lockout:** If using RS485/RS232, verify communication settings do not prevent local operation.

8.1 Error Codes

The Batch Controllers feature self-test facilities that display error codes when an invalid condition is detected. Errors are displayed as **"Err xx"** (e.g., **Err 12**).

If an error occurs that is not listed here, contact the factory or your authorized service provider.

Code	Description
11	Invalid input configuration programmed.
13	Signal Timeout exceeded (see Section 3.2.2).
14	Communications input error (RS232/422/485 interface).
15 *(424 only)*	Invalid digital input state at startup or during operation.

Table 16: Inupt Errors

Code	Description
21	Invalid output configuration.
22	Communications error – Baud rate not set.
23	Communications error – Printer fault.
24 *(424 only)*	Output assignment conflict (multiple functions assigned to the same terminal).

Table 17: Output Errors

Code	Description
30	Zero value not allowed.
33	Invalid printer type selected.
34	Invalid volume units selected.
35 *(424 only)*	Calibration parameter out of range.

Table 18: Calibration Errors

HYGIENIC BY DESIGN

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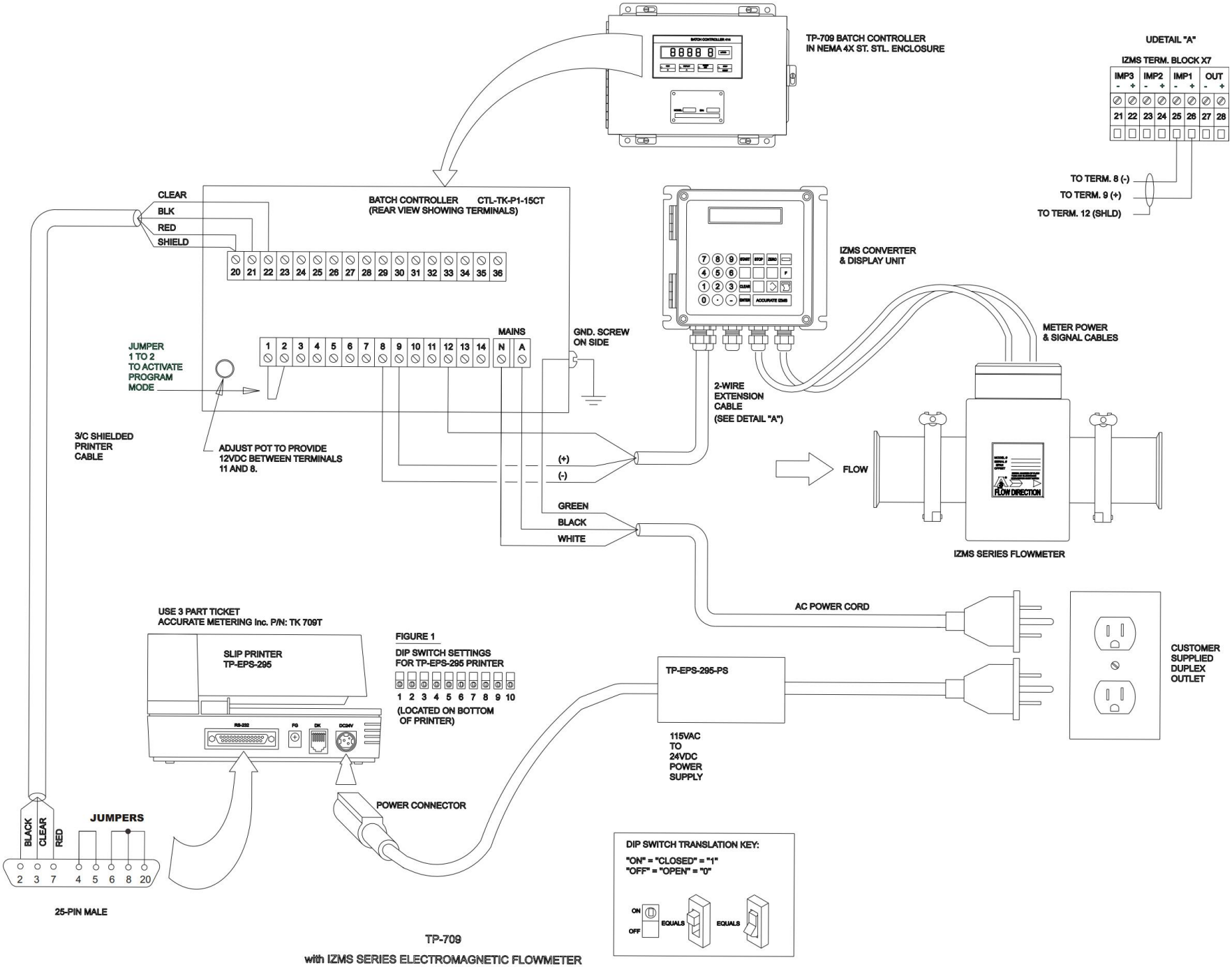

TP-709

with IZMS SERIES ELECTROMAGNETIC FLOWMETER

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Warranty

These products are warranted to be free from functional defects in materials and workmanship at the time the products leave the Anderson-Negele factory and to conform at that time to the specifications set forth in the relevent Anderson instruction manual or manuals, sheet or sheets, for such products for a period of one year.

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Anderson-Negel shall not be liable for any incidental damages, consequential damages, special damages, or any other damages, costs or expenses excepting only the cost or expense of repairs ore replacement as described above. Products must be installed and maintained in accordance with Anderson instructions. Users are responsible for the suitability of the products to their application. There is no warranty against damage resulting from corrosion, misapplication, improper specifications or other operating condition beyond our control. Claims against carriers for damage in transit must be filed by the buyer. This warranty is void if the purchaser uses non-factory approved replacement parts and supplies or if the purchaser attempts to repair the product themselves or through a third party without Anderson-Negele authorization.

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Anderson-Negele‘s sole and exclusive obligation and buyer's sole and exclusive remedy under the above warranty is limited to repairing or replacing (at Anderson-Negele's option), free of charge, the products which are reported in writing to Anderson-Negele at its main office indicated below.

Anderson-Negele is to be advised of return requests during normal business hours and such returns are to include a statement of the observed deficiency. The buyer shall pre-pay shipping charges for products returned and Anderson or its representative shall pay for the return of the products to the buyer.

An RMA (Return Merchandise Authorization) must be obtained from Anderson-Negele Customer Service before returning merchandise.

Approved returns should be sent to:

Anderson -Negele
156 Auriesville Rd. Fultonville, NY 12072
ATTN: Repairs
Write RMA number on outside of package