**Function Blocks**

**[Numerical Listing by FB Number]**

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<th>Analog Input #1</th>
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<td>Analog Output #1</td>
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<td>Digital Output #1</td>
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<td></td>
<td>PID Control</td>
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<tr>
<td></td>
<td>ID Control</td>
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<td>FB34</td>
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<td>FB36</td>
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<td>FB37</td>
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<td>FB39</td>
<td>Quad One-Shot Timer #1</td>
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<td>FB40</td>
<td>Quad One-Shot Timer #2</td>
</tr>
<tr>
<td>FB41</td>
<td>Quad Flip/Flop #1</td>
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<tr>
<td>FB42</td>
<td>Quad Flip/Flop #2</td>
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<tr>
<td>FB43</td>
<td>Quad Flip/Flop #3</td>
</tr>
<tr>
<td>FB44</td>
<td>Repeat Cycle Timer #2</td>
</tr>
<tr>
<td>FB45</td>
<td>Batch Totalizer #2</td>
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<tr>
<td>FB46</td>
<td>Multiplier/Divider #1</td>
</tr>
<tr>
<td>FB47</td>
<td>Multiplier/Divider #2</td>
</tr>
<tr>
<td>FB48</td>
<td>Adder/Subtractor #1</td>
</tr>
<tr>
<td>FB49</td>
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</tr>
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<td>FB50</td>
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<td>FB51</td>
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</tr>
<tr>
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</tr>
<tr>
<td></td>
<td>Voltage</td>
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</tr>
<tr>
<td></td>
<td>Millivolt or Thermocouple</td>
</tr>
<tr>
<td></td>
<td>RTD</td>
</tr>
<tr>
<td></td>
<td>Frequency</td>
</tr>
</tbody>
</table>

Function Block Master Foldout
These function blocks convert an analog voltage into a 0-100% signal used by other blocks. A digital filter in each block allows process noise to be minimized. Analog inputs can be linearized through use of a selectable square root extraction. Configuration of FB01 and FB02 consists of entering a breakpoint frequency for the digital filter, selecting square root extraction, and connecting the output to other blocks, as required. Zero and full scale input information are defined during calibration. Refer to Instruction SD382 for calibration information.

**Specifications**

Type: Single-ended  
Accuracy: 0.05%  
Zero and Span: 0 to 1.0 Vdc and 4 to 5 Vdc  
Normal Mode Rejection: 6 db at 2 Hz, 60 db at 60 Hz  
Input Impedance: greater than 1 megohm  
Max. Continuous Input: ±30 Vdc  
Temperature Effect: less than ±0.5% change of span in a 100°F ambient

**Output Identifications**

FB01: 01  
FB02: 02

**Terminal Designations**

FB01: A1+ (A4)  
AIC- (A5)  
FB02: A12+ (A6)  
AIC- (A5)

**Block Diagram**

---

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This function block provides a 4-20 mA dc analog output from a 0%-100% signal from other function blocks. Each block includes an additional on/off switch input that disconnects the 4-20 mA signal from the load. This switch can be used when two or more outputs are connected to the same load. Configuration consists of entering the appropriate block identification used as the signal output, and, if required, the block used as an on/off switch. Zero and full scale are defined during calibration of the controller. Refer to SD382 for calibration information.

**Specifications**

Range: 4-20 mA dc
Zero: 4.0 mA dc ± trim
Span: 16 mA dc ± trim
Accuracy: ±0.1% of span
Output Load: 0-800 ohm
Open Circuit Voltage: 26V ± 10%
Output Current Limit: 20.5 mA ± 0.1 mA
Switch Action: opens when INB ≥ 80%; closes when INB < 75%

**Terminal Designations**

FB03: A01+ (A7)
AOC- (A8)

**FB03 ANALOG OUTPUT #1**

<table>
<thead>
<tr>
<th>Signal</th>
<th>Description</th>
<th>Values</th>
</tr>
</thead>
<tbody>
<tr>
<td>C201</td>
<td>ZERO OUTPUT</td>
<td>4.0 mA dc</td>
</tr>
<tr>
<td>CF01</td>
<td>FULL SCALE OUTPUT</td>
<td>20.0 mA dc</td>
</tr>
<tr>
<td>CV01</td>
<td>VERIFY OUTPUT</td>
<td>-3.3 to 103.3%</td>
</tr>
<tr>
<td>HINA</td>
<td>INPUT A (SIGNAL)</td>
<td>0 to 215</td>
</tr>
<tr>
<td>HINB</td>
<td>INPUT B (ON/OFF)</td>
<td>0 to 215</td>
</tr>
</tbody>
</table>

**BLOCK DIAGRAM**

For additional Analog Output Function Block see FB60.
Digital on/off signals to actuate field devices can be controlled with these function blocks. FB04 and FB05 provide a transistor output that turns on when the input equals or exceeds 80% and turns off when it drops below 75%. These two function blocks can be used for loads such as relays, solid state annunciators, etc.

Configuration consists of entering another function block’s output identification as the input to either FB04 or FB05.

**Specifications**

Type: Open collector transistor with emitter tied to station common

Load Voltage: 30 Vdc (max.)

Load Current: 100 mA (max.)

Switch Action: On when INA \( \geq 80\% \)

Off when INA \( < 75\% \)

"ON" Voltage: 0.3V (max.) at 0 mA load

0.6V (max.) at 100 mA load

Off State Leakage: 200 \( \mu A \) at 30 Vdc

**Terminal Designations**

FB04: B4 (DO+)  
B7 (DOC–)

FB05: B6 (DO2+)  
B7 (DOC–)

**Block Diagram**

```
INPUT
A

DO +

DOC –
```

**FB04**

**DIGITAL OUTPUT #1**

```
FB04
DO+ (B4)
DOC- (B7)
```

**HINA**

INPUT A (ON/OFF) ................. 0 to 215

**FB05**

**DIGITAL OUTPUT #2**

```
FB05
DO2+ (B6)
DOC- (B7)
```

**HINA**

INPUT A (ON/OFF) ................. 0 to 215
This function block provides an on/off signal for use by other blocks. The function block output (16) is 0% when input is off and 100% when it is on. The normal input voltage is 24 Vdc. Configuration consists of using the output 16 as an input to other function blocks.

Specifications
Logic 1 Threshold: 15V (min.)
Logic 0 Threshold: 1V (max.)
Action: Input signal above logic 1 threshold produces 100% logic signal output; below logic 0 threshold, 0% signal produced.
Maximum Continuous Input: ±30 Vdc
Current Draw: 10 mA (max.) at 24 Vdc
Isolation: 100 Vdc
On/Off Time: 500 msec (min.)

Output Identification
FB06: 16

Terminal Designations
FB06: DI1+ (B8)
     DI1- (B9)

| BLOCK DIAGRAM |
Multi-stage, repeatable control applications, such as setpoint profiling, heat/cool cycling, ramp-soak operations, etc. can be implemented in the Model 382 with the Programmer function block. A total of 20 definable segments are available to characterize the program. Two independent Program Followers, which may operate simultaneously, consecutively, etc., are provided to execute the information configured in each of the segments. Segments are defined with a completion point and a segment time. The Program Followers include the capability to Hold at a specific position within a segment, or reset to the start of a designated Reset segment. The Reset is ignored if the Hold input is active.

Each segment starts at the completion point of the previous segment. The active segment and time remaining can be viewed on the 5-Digit Display when PF1 or PF2 (Program Followers 1 & 2) are displayed on the alphanumeric display. Program followers can be forced to a new segment or remaining time with the FORCE button. A follower must be running to be forced.

Configuration of the Programmer consists of defining the segments used, and determining the inputs to the Program Followers that will Hold or Reset the Programmer. Segments can start at any value from -3.3% to 103.3%. The starting point for segment 1 can be established via the T input by setting input C high. Tracking works only at the reset stage and will not force the output of the follower to be equal to the tracking input while the programmer is running. Tracking stops if input C goes low, or if PF1 or PF2 is on segment 1. The HOLD input to the follower stops the follower when it exceeds 80%. The RESET input returns to the start of the reset segment when it exceeds 80%. If a follower is held in the reset position, tracking can be enabled by setting input C high, provided the other follower is not on segment 1.

Outputs of the function block are the two Program Followers and Step outputs that provide a momentary 100% signal each time either Follower starts a segment.

Output Identifications:
- FB07: Follower 1...03
- Follower 1 Step...10
- Follower 2...04
- Follower 2 Step...20

(continued on next page)
SEG. 1 COMPLETION PT .... -3.3% to 103.3%
SEG. 1 TIME ............. 0.0 to 250 min.
SEG. 2 COMPLETION PT .... -3.3% to 103.3%
SEG. 2 TIME ............. 0.0 to 250 min.
SEG. 3 COMPLETION PT .... -3.3% to 103.3%
SEG. 3 TIME ............. 0.0 to 250 min.
SEG. 4 COMPLETION PT .... -3.3% to 103.3%
SEG. 4 TIME ............. 0.0 to 250 min.
SEG. 5 COMPLETION PT .... -3.3% to 103.3%
SEG. 5 TIME ............. 0.0 to 250 min.
SEG. 6 COMPLETION PT .... -3.3% to 103.3%
SEG. 6 TIME ............. 0.0 to 250 min.
SEG. 7 COMPLETION PT .... -3.3% to 103.3%
SEG. 7 TIME ............. 0.0 to 250 min.
SEG. 8 COMPLETION PT .... -3.3% to 103.3%
SEG. 8 TIME ............. 0.0 to 250 min.
SEG. 9 COMPLETION PT .... -3.3% to 103.3%
SEG. 9 TIME ............. 0.0 to 250 min.
SEG. 10 COMPLETION PT .... -3.3% to 103.3%
SEG. 10 TIME ............. 0.0 to 250 min.
SEG. 11 COMPLETION PT .... -3.3% to 103.3%
SEG. 11 TIME ............. 0.0 to 250 min.
SEG. 12 COMPLETION PT .... -3.3% to 103.3%
SEG. 12 TIME ............. 0.0 to 250 min.
SEG. 13 COMPLETION PT .... -3.3% to 103.3%
SEG. 13 TIME ............. 0.0 to 250 min.
SEG. 14 COMPLETION PT .... -3.3% to 103.3%
SEG. 14 TIME ............. 0.0 to 250 min.
SEG. 15 COMPLETION PT .... -3.3% to 103.3%
SEG. 15 TIME ............. 0.0 to 250 min.
SEG. 16 COMPLETION PT .... -3.3% to 103.3%
SEG. 16 TIME ............. 0.0 to 250 min.
SEG. 17 COMPLETION PT .... -3.3% to 103.3%
SEG. 17 TIME ............. 0.0 to 250 min.
SEG. 18 COMPLETION PT .... -3.3% to 103.3%
SEG. 18 TIME ............. 0.0 to 250 min.
SEG. 19 COMPLETION PT .... -3.3% to 103.3%
SEG. 19 TIME ............. 0.0 to 250 min.
SEG. 20 COMPLETION PT .... -3.3% to 103.3%
SEG. 20 TIME ............. 0.0 to 250 min.
PF1 HOLD INPUT (A) ........... 0 to 215
PF1 RESET INPUT (B) ........... 0 to 215
PF2 HOLD INPUT (D) ........... 0 to 215
PF2 RESET INPUT (E) ........... 0 to 215
TRACK COMMAND INPUT (C) ........... 0 to 215
FOLLOWER 1 RESET ........... 1 to 20
FOLLOWER 1 COMPLETION ........... 1 to 20
FOLLOWER 2 RESET ........... 1 to 20
FOLLOWER 2 COMPLETION ........... 1 to 20
Repeat Cycle Timer #1

This timer is available to provide an output to other blocks at selectable, repeating, timed intervals ranging up to 9999 minutes. These timers can be selectively started, stopped, or held for a specific time period as either on or off. Additionally, the "on" time can be modified with an additional input.

The time remaining can be displayed using the "DISP TIMER" button. The value can be changed via the FORCE button if the timer is running. The time cannot be forced if the adaptive input is used.

**Start**
When input B equals or exceeds 80%, the timer output goes from 0% to 100% and remains at that level for time TN. The output returns to 0% for time TF. This cycle repeats until stopped.

**Stop**
When input B drops below 75%, the timer output immediately goes to 0%.

**Adaptive On Time**
When TF = 0.0, the TIME PERIOD remains fixed (equal to TN) and ON time varies from 0 to TN as A changes from 0 to 100%. When TF is greater than 0.0, the OFF time TF remains fixed (equal to TF) and ON time varies from 0 to TN as A changes from 0 to 100%.

Configuration of this block consists of entering the required on/off times in minutes, selecting the appropriate function block output identification to start, stop, or hold the timer, and selecting the Adaptive On input to modify the on time.

**Output Identification**
FB08: 06

---

**FB08 REPEAT CYCLE TIMER #1**

<table>
<thead>
<tr>
<th>Input</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>S</td>
<td>TIME OFF .................. 0.00 to 9999 min</td>
</tr>
<tr>
<td>T</td>
<td>TIME ON ................... 0.00 to 9999 min</td>
</tr>
<tr>
<td>F</td>
<td>ADAPTIVE ON TIME INPUT (A) 0 to 215</td>
</tr>
<tr>
<td>N</td>
<td>START/STOP INPUT (B) ...... 0 to 215</td>
</tr>
<tr>
<td>H</td>
<td>HOLD INPUT (H) ............ 0 to 215</td>
</tr>
</tbody>
</table>

---

**BLOCK DIAGRAM**

For additional Repeat Cycle Timer Function Block see FB44.
This block allows a single, selected input to be limited according to variable high and low limit values which are used as the output when the input exceeds or falls below the respective setting. When the input to FB09 is between each limit, the block output equals input. When the input is below the pre-selected lo limit, the output is the lo limit setting. When the input exceeds the hi limit, the output corresponds to the hi limit setting. The Hi Limit Status is 0% when input A is less than Hi Limit and 100% when A is greater than or equal to the Hi Limit. The Lo Limit Status is 0% when input A is greater than the Lo Limit and 100% when A is less than or equal to the Lo Limit.

Configuration consists of selecting the appropriate high and low values to be used to limit the input; and selecting another function block’s output as the input to FB09.

Output Identifications
FB09
Block Output: 05
Lo Limit Status: 30
Hi Limit Status: 31

BLOCK DIAGRAM
This function block allows an input to be totalized and scaled in pulses per hour (PPH). A maximum of 99999 pulses can be counted and displayed. Full scale range can be selected from 20-18,000 PPH. A zero drop-out selection allows the input to be limited to above a defined level. It causes the integrator to stop pulsing when input A drops below the ZDO setting. Hi and Lo Comparators provide 100% block outputs when the Hi or Lo setting is reached and a 0% output when below tripoint. The totalizer can be reset when INPUT R equals or exceeds 80%. The totalizer will reset to zero and immediately start counting any pulses on the same cycle. INPUT R must fall below 75% in order to reset the counter. Counting continues until reset input falls below 75% and resumes a rising edge. Additionally, a Pulse output is available to drive external counters or other blocks.

The totalizer counts and Lo & Hi Comparator settings can be displayed on the 5-Digit Display via the D pushbutton. The FORCE button can be used to change comparator settings. The Lo Output Status is 0% when count is less than setting and 100% when count is greater than or equal to setting. The Hi Output Status is 0% when count is less than setting and 100% when greater than or equal to setting.

Configuration of the Batch Totalizer consists of selecting the pulse input, range, zero drop-out level, comparator settings, and the reset input.

Output Identifications

FB10
Pulse: 07
Hi Comparator Status: 08
Lo Comparator Status: 09

For additional Batch Totalizer Function Block see FB45.
Step-oriented operations can be controlled by the Model 382 via the Sequencer Function Block. Up to 20 separate steps can be used. Each step can produce up to 16 on/off (100% or 0%) outputs. Additionally, steps can be defined with up to 15 input conditions to be fulfilled before the sequencer advances to the next step. Timed steps are also available.

A STEP input advances the block to the next step. A STEP output goes high for 0.1 sec. each time the Sequencer advances to the next step, when the Sequencer is FORCED to a new step or when the Sequencer is reset to step 1. The STEP output does not pulse when the Sequencer is reset to step 0 or forced to step 0. The Sequencer advances when: the STEP input goes high, a step's time elapses, or the pattern of inputs go high before the step's time elapses. When setting up an event-driven step, the time for that step should be set to 0.0. When getting up a timed step, a "dummy" input must be configured in the "S" mode for that step. If a "dummy" input is not configured, the Sequencer will immediately advance to the next step. When setting up a timed and event-driven step, the Sequencer will advance when the timer "times out" or when the configured inputs go high. A RESET input returns to step 0. A HOLD input maintains the block on the present step. If the STEP and RESET inputs go high during the same execution cycle, the block resets to step 1. STEP and RESET are ignored if the Hold input is active.

**STEP INPUT/OUTPUT CODING**

The 0% or 100% pattern for each of the inputs or outputs of the Step values (S11-20, S01-20) of the Sequence Function Block are represented by a 4-digit Step Input/Output code. Use the table below to generate the corresponding code configuration entry for each step.

### Desired Input/Output States

<table>
<thead>
<tr>
<th>Desired Input/Output States</th>
<th>Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 0 0 0</td>
<td>0</td>
</tr>
<tr>
<td>0 0 0 X</td>
<td>1</td>
</tr>
<tr>
<td>0 0 X 0</td>
<td>2</td>
</tr>
<tr>
<td>0 0 X X</td>
<td>3</td>
</tr>
<tr>
<td>0 X 0 0</td>
<td>4</td>
</tr>
<tr>
<td>0 X 0 X</td>
<td>5</td>
</tr>
<tr>
<td>0 X X 0</td>
<td>6</td>
</tr>
<tr>
<td>0 X X X</td>
<td>7</td>
</tr>
<tr>
<td>X 0 0 0</td>
<td>8</td>
</tr>
<tr>
<td>X 0 0 X</td>
<td>9</td>
</tr>
<tr>
<td>X 0 X 0</td>
<td>A</td>
</tr>
<tr>
<td>X 0 X X</td>
<td>B</td>
</tr>
<tr>
<td>X X 0 0</td>
<td>C</td>
</tr>
<tr>
<td>X X 0 X</td>
<td>D</td>
</tr>
<tr>
<td>X X X 0</td>
<td>E</td>
</tr>
<tr>
<td>X X X X</td>
<td>F</td>
</tr>
</tbody>
</table>

The active step and time remaining can be viewed on the 5-digit display when Seq (Sequence) is displayed on the alphanumerical display. A sequence or step can be forced to a new step or time remaining with the force button.

Configuration consists of selecting the on/off pattern of each step's inputs and outputs, and selecting the STEP, RESET and HOLD inputs. The input and output patterns are specified by a Step Input/Output Code ranging from 0000 through FFFF. A worksheet provided in Section 5 of this manual can be used to generate the corresponding entries for each step's input or output. Turning the Pulser selects input/output code entries during configuration. Use the D (Display) pushbutton to select successive entries, from right to left, as shown on the 5-digit display.

The STEP input advances to the next step when this input exceeds 80%. It must decrease to 75% and return to 80% before another step is performed. The HOLD input will maintain the block at the current step when it exceeds 80%. The block remains in HOLD until it drops to 75%. The Reset step conditions can be configured with a pre-selected output pattern when the Reset Input goes high.

**Output Identifications**

FB11: 34 through 50

Inputs are grouped: A-D, E-H, I-L, M-P

Outputs are grouped: 34-37, 38-41, 42-45, 46-49

Examples:

**Inputs:**

POPM  LKJI  HGFEDCBA

**Step Input Pattern:**

0 0 X X  X X 0 X  X 0 X X  X 0 X X 0

**Configuration Entry:**

3 0 8 5 0 0 0 9 1 2 3

**Step Output Pattern:**

0 X X X 0 0 0 X X X X X X

**Configuration Entry:**

7 2 4 3 0 0 0 9 1 2 3

(continued on next page)
This block provides 3 alarms, one deviation and 2 absolute, for use within a configuration. Tripoint values and alarm deadband range can be defined for each alarm. Alarms can be either Hi or Lo alarms. The Absolute alarms compare a preselected alarm tripoint value with the input. The Deviation alarm compares two inputs and provides an alarm output if the absolute value meets or exceeds the deviation alarm tripoint. The alarm status outputs go high (100%) when the selected alarm limit is exceeded.

If inputs A or B are not configured, the corresponding default value will be set to 0%. If inputs C & D are not configured, deviation default value is set to 0%. If only input C (INC) is configured, input D (IND) will be set to 0% (Hi Alarm) and if only input D is configured, input C will be set to 100%. Otherwise, the deviation alarm functions normally.

Configuration of this block consists of selecting the desired types of alarms and limits and determining the Function Block output identification to serve as alarm inputs.

**Output Identifications**
FB12
- Status AS1: 11
- Status AS2: 12
- Status DS: 13
The Controller function block provides an extensive range of Proportional-Integral-Derivative functions including:

**PID, PD, ID, PID with Adaptive Gain**

**PID**

When this type is selected, the block functions as a PID controller with reset feedback and can be configured for various control schemes including override, reset limiting, etc. This selection can also be used as a PI Controller by entering a value of 0.00 minutes as the Derivative Time (STD1) selection. The controller includes a Track Command input (HINC) that allows the block's output to track the feedback (HINF) when the signal equals or exceeds 80% and returns to normal operation if it drops below 75%. If HINC is not selected during configuration, it is set to 0, non-tracking.

**Equation**

\[ O = GE + R \]

**NORMAL (C = 0%)**

\[ R = \frac{F}{TIS + 1} \]

**WHEN OUTPUT (O) IS CONNECTED TO FEEDBACK (F)**

\[ 0 = \frac{PG}{1 + \frac{TDS}{(TD/DS)S + 1} + S} \left[ 1 + \frac{1}{TIS} \right] \]

**TRACK (C = 100%)**

\[ R = F - GE : O = F \]

**Output Identifications**

FB13

Block Output: 14

IError: 15

---

*Does not apply to Type 3  **Type 2 only  ***Type 4 only*
PD Controller

The PD controller is a proportional only with manual reset which can be selected as tracking or non-tracking.

The “Track Command” input ("C") will force the controller output to track the feedback and if manual reset tracking was selected, the manual reset (MR) will also track the feedback. In either case, the controller will always go back to normal action with the output equal to the feedback. The reset value (R) will then return to the value of MR with a time constant established by the integral time (Ti). Since the default value of Ti is 100 min, it should be reduced (e.g. 0.01 min.) when using this controller type.

If the derivative time TD is set equal to 0.00, the derivative section is eliminated.

The integral time is not used to establish Reset for this type controller. It is only a first order lag.

**Equation**

\[
O = GE + R
\]

**NORMAL (C = 0%)**

\[
R = -\frac{MR}{Ti_s + 1}
\]

**TRACK (C = 100%)**

\[
R = F - GE
\]

IF MRT = YES

\[
MR = F
\]

**Output Identifications**

FB13

Block Output: 14

IE Error: 15

---

**FB13 CONTROLLER**

- PROCESS INPUT
- SETPOINT INPUT
- TRACK COMMAND
- FEEDBACK

**BLOCK DIAGRAM**

(continued on next page)
ID Controller

When this type is selected, the block functions as an ID Controller. It can also be used as an Integral-Only Controller when the derivative time (STD1) selection is set to 0.00 minutes.

The gain for this type controller is at a fixed value of 1.00. While the displayed gain can be changed, it will not affect the controller.

**Equation**

\[
0 = \frac{GE + F}{TIs + 1}
\]

**NORMAL (C = 0%) WHEN OUTPUT (O) IS CONNECTED TO FEEDBACK (F)**

\[
0 = \pm \frac{PG}{TIs + 1}
\]

**TRACK (C = 100%)**

\[
0 = F
\]

Output Identifications

FB13

Block Output: 14

IError: 15

**FB13 CONTROLLER**

- **PROCESS INPUT**
  - TDs
  - TD
  - DG

- **SETPOINT INPUT**
  - ABS
  - +/- GE
  - +/- F

- **FEEDBACK**
  - IError

- **OUTPUT**

- **TRACK COMMAND**

**BLOCK DIAGRAM**

(continued on next page)
PID (Adaptive Gain) Controller

PID with Adaptive Gain
When this type is selected, the block functions as a PID Controller as previously described except that it includes an input that alters the proportional gain setting as a function of signal level and an additional output providing a signal proportional to absolute error.

Equation

\[ 0 = GE + R \]

NORMAL (C = 0%) \[ R = \frac{F}{T_is + 1} \]

WHEN OUTPUT (D) IS CONNECTED TO FEEDBACK (F)

\[ 0 = +/- PG \cdot AG \left[ P \left( 1 + \frac{T_D}{s} \right) - S \right] \left[ 1 + \frac{1}{T_is} \right] \]

TRACK (C = 100%) \[ R = F - GE \cdot 0 = F \]

Output Identifications
FB13
Block Output: 14
IERRort. 15

Block Diagram

---

FB13 CONTROLLER

PROCESS \[ \text{IN} \]
SETPOINT \[ \text{INS} \]
FEEDBACK \[ \text{INF} \]
ADAPTIVE GAIN \[ \text{INA} \]
TRACK COMMAND \[ \text{INC} \]

15 \[ \text{ERROR} \]
14 \[ \text{OUTPUT} \]

REVERSE (-) OR DIRECT (dir) ACTING \[ -, +/\text{dir} \]
PROPORTIONAL GAIN \[ 0.01 \text{ to } 100.0 \]
TIME-INTEGRAL \[ 0.01 \text{ to } 1000 \text{ M/R} \]
TIME-DERIVATIVE \[ 0.00 \text{ to } 100.0 \text{ min} \]
DERIVATIVE GAIN \[ 1.00 \text{ to } 30.00 \]
MANUAL RESET \[ 0 \text{ to } 100 \% \]
TYPE \[ 1/\text{PID}/2/\text{PD}/3/\text{ID}/4/\text{PIDAG} \]
MANUAL RESET TRACKING \[ \text{No/Yes} \]
PROCESS INPUT \[ \text{P} \]
SETPOINT INPUT \[ \text{S} \]
FEEDBACK INPUT \[ \text{F} \]
ADAPTIVE GAIN INPUT \[ \text{A} \]
 TRACK COMMAND INPUT \[ \text{C} \]

* Does not apply to Type 3 ** Type 2 only *** Type 4 only

---

PROCESS INPUT

\[ \frac{T_D s}{T_D + 1} \]

SETPOINT INPUT

ABS

ADAPTIVE GAIN

TRACK COMMAND

BLOCK DIAGRAM

---
The Auto/Manual Transfer block serves as a switch to select either an Auto output, or an internal, manual output. The 5-digit display on the controller’s faceplate displays an “S” (Setpoint) when the A/M block is switched to A and V (Valve) when switched to M. An input to this block allows control to be toggled between Auto and the internal manual. Outputs include status outputs to indicate which mode (Auto/Manual) is active. The Auto Status is 100% in Auto and 0% in Manual. The Manual Status is 100% in Manual and 0% in Auto.

Configuration of this block consists of determining the Auto input (INA) and the Auto/Manual Switch input (INS), and connecting the appropriate outputs to other blocks. The block changes from auto/manual for each positive transition (i.e. when INS is below 75%, exceeds 80%, and returns to less than 75%).

Output Identifications

FB14
Output: 17
Auto Status: 18
Manual Status: 19
The Operators Display block allows displays and pushbuttons on the faceplate to be selected to show control values and operate the controller. Inputs are available to be configured for display of the following when the display (D) pushbutton is used: P, S, V, X, Y.

Additionally, the operation of each program follower of the Programmer, operation of the Sequencer, and the counts and Hi/Lo comparator settings for the Batch Totalizers can be displayed when configured. The time of day is also displayed, when configured.

Status Lights L1 through L20 can be individually selected for display. Three, separate inputs (B, C, & D) are available to flash a Status Light on and off. Flashing can be stopped with the ACK (acknowledge) pushbutton, or when the Acknowledge (INA) input goes high. A Pulse-On output goes high for 0.5 sec each time a flasher input makes a transition from Lo to Hi. A Pulse-Off output is also available that goes high for 0.5 sec when a flashing light stops flashing (flasher input goes from Hi to Lo or flashing light is acknowledged). The Flasher is activated when its input is greater than 80% and stops when it is less than 75%, unless not self-clearing. FLA, FLB and FLC determine which light is to flash on/off when Flasher is activated. A forced I/O output is available that goes high when any of the Configurable I/O is in a Forced state (Model 382E only). An Error output goes high if an error is detected within the controller.

Three momentary action pushbuttons are available to be configured to start/stop specific functions. Each button provides a 100% signal as long as button is pressed.

Output Identifications

FB15
PB1: 21
PB2: 22
PB3: 23
Pulse-On: 24
Pulse-Off: 25
Error: 26
Forced I/O: 27

---

(continued on next page)
Operators Display

5-Digit Display

Pushbutton Outputs

TO FB96

L1-L20

Flasher 1.2.3

PB1

PB2

PB3

L1  L11
L2  L12
L3  L13
L4  L14
L5  L15
L6  L16
L7  L17
L8  L18
L9  L19
L10 L20

Alpha Numeric

D

ACK

PSVXY

Input A

Programmer Sequencer Totalizers Time

Block Diagram
This function block maintains a tracking or non-tracking setpoint value for use by other blocks. The block's value can be changed if not tracking and $S$ is displayed, or if $X$ or $Y$ are displayed and $X$ or $Y$ are connected to the output of FB17.

**Output Identification**

FB17: 28
This block maintains a tracking or non-tracking value for use by other blocks. The value can be changed if not tracking if X or Y is displayed and X or Y is connected to the output of FB18.

Output Identification

FB18: 29
Each of the 12 logic blocks provide the ability to perform logic functions on four pairs of inputs to provide four outputs per block. Logic elements are individually selected for a designated pair of inputs. Functions include AND, NAND, OR, NOR, EOR (Exclusive OR).

Configuration consists of selecting the required type of logic for a pair of inputs and entering a function block output number for the inputs.

**TRUTH TABLE**

<table>
<thead>
<tr>
<th>INPUTS</th>
<th>1</th>
<th>2</th>
<th>AND</th>
<th>NAND</th>
<th>OR</th>
<th>NOR</th>
<th>EOR</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
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<td>0</td>
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<td>1</td>
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<td>1</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

Inputs 1 and 2 can be any pair (A & B, C & D, E & F, or G & H) of each Quad Logic function blocks.

**QUAD LOGIC OUTPUTS**

- **FUNCTION BLOCK** | **INPUTS** | **OUTPUTS**
  - 20 A & B | 51 |
  - A & B | 55 |
  - A & B | 59 |
  - A & B | 63 |
  - A & B | 67 |
  - A & B | 71 |
- **FUNCTION BLOCK** | **INPUTS** | **OUTPUTS**
  - 26 A & B | 75 |
  - A & B | 79 |
  - A & B | 83 |
  - A & B | 87 |
  - A & B | 91 |
- **FUNCTION BLOCK** | **INPUTS** | **OUTPUTS**
  - 27 A & B | 77 |
  - A & B | 81 |
  - A & B | 85 |
  - A & B | 89 |
  - A & B | 93 |

**LOGIC TYPE**

- **INPUTS A & B**
- **INPUTS C & D**
- **INPUTS E & F**
- **INPUTS G & H**
This function block is available to compute the difference between two inputs and multiply it by a user-selected gain value. The result can be summed as the output of the block. Configuration consists of selecting the A, B, and C inputs to the block and selecting a gain value. Default values for unconfigured Input A will be set to 100% and inputs B & C to 0%.

**Equation**  
Output = Gain \( (A - B) + C \)

**Output Identification**  
FB32: 100

---

For additional Deviation Amplifier Function Block see FB50.
This block operates similar to a DPDT switch to allow 2 of 4 inputs to be selected by a single switch command input. Outputs will switch when a command input is greater than or equal to 80% or drops below 75%.

If inputs A and D are not configured, the default values will be set to 100% with inputs B, C, and E set to 0%.

Configuration consists of selecting the inputs to switch #1 (A & B), switch #2 (D & E), and the switch command input (C).

Equations
If C < 75% then output 1 = A and output 2 = 0
If C ≥ 80% then B = output 1 and E = output 2

Output Identifications
FB33
Switch 1: 101
Switch 2: 102

For additional Dual Transfer Switch Function Block see FB52.
This block provides 4 Comparators that compares an input with a pre-selected trippoint to furnish an on/off output. Each of the four comparators can be separately defined according to trippoint, deadband, and direct or reverse action.

Configuration consists of assigning inputs to any of the four comparators (INA-IND), selecting the required action (direct or reverse), and determining the trippoint and deadband levels.

**Equations**

**Direct Acting**: (Hi Alarm)
- If input $\geq$ trippoint then output = 100%
- If input $<$ (trippoint-deadbend) then output = 0%
- If input $\leq$ (trippoint-deadbend) and input $<$ trippoint then output remains unchanged

**Reverse Acting**: (Lo Alarm)
- If input $\leq$ trippoint then output = 100%
- If input $>$ (trippoint-deadbend) then output = 0%
- If input $\geq$ (trippoint-deadbend) and input $>$ trippoint then output remains unchanged

**Output Identifications**

- FB34
- Comparator 1: 103
- Comparator 2: 104
- Comparator 3: 105
- Comparator 4: 106
Quad Delay Timers #1 & #2

Up to four separate On-Delay/Off-Delay operations can be performed with each of these function blocks. Each block allows four separate inputs to be delayed for a user-specified amount of time. Timers can be either On or Off type. Additionally, a Hold input is available to hold all timers within the block.

The time remaining for each delay can be displayed at the faceplate of the Model 382 by using the "DISP TIMER" pushbutton. Timer values can be changed with the "FORCE" pushbutton if the timer is running.

**Output Identifications**

<table>
<thead>
<tr>
<th>FB35</th>
<th>FB36</th>
</tr>
</thead>
<tbody>
<tr>
<td>Timer 1: 110</td>
<td>Timer 5: 114</td>
</tr>
<tr>
<td>Timer 2: 111</td>
<td>Timer 6: 115</td>
</tr>
<tr>
<td>Timer 3: 112</td>
<td>Timer 7: 116</td>
</tr>
<tr>
<td>Timer 4: 113</td>
<td>Timer 8: 117</td>
</tr>
</tbody>
</table>

**FB35 Quad Delay Timer #1**

- **S01** DELAY TIME 1: 0.00 to 9999 min.
- **S02** DELAY TIME 2: 0.00 to 9999 min.
- **S03** DELAY TIME 3: 0.00 to 9999 min.
- **S04** DELAY TIME 4: 0.00 to 9999 min.
- **H** TIMER TYPE 1: Off/On
- **H** TIMER 1 INPUT (A): 0 to 215
- **H** TIMER 2 INPUT (B): 0 to 215
- **H** TIMER 3 INPUT (C): 0 to 215
- **H** TIMER 4 INPUT (D): 0 to 215
- **H** HOLD INPUT (H): 0 to 215

**FB36 Quad Delay Timer #2**

- **S05** DELAY TIME 5: 0.00 to 9999 min.
- **S06** DELAY TIME 6: 0.00 to 9999 min.
- **S07** DELAY TIME 7: 0.00 to 9999 min.
- **S08** DELAY TIME 8: 0.00 to 9999 min.
- **H** TIMER TYPE 5: Off/On
- **H** TIMER 5 INPUT (A): 0 to 215
- **H** TIMER 6 INPUT (B): 0 to 215
- **H** TIMER 7 INPUT (C): 0 to 215
- **H** TIMER 8 INPUT (D): 0 to 215
- **H** HOLD INPUT (H): 0 to 215

**OFF-DELAY** — When the input is HIGH the output is HIGH. If the input goes LOW the timer waits for the delay time (DT) and will then go LOW provided the input is still LOW.

**ON-DELAY** — When the input is LOW the output is LOW. If the input goes HIGH the timer waits for the delay time (DT) and will then go HIGH provided the input is still HIGH.
The Quad Divide-By N Counters allow multiple pulse inputs to be converted to a single pulse output at a user-selected rate. Each block provides 4 outputs that change state (100% or 0%) upon a selected number of positive transitions of each counter’s input. A reset input is available to return all counters and outputs to zero.

Configuration consists of assigning the counter inputs and selecting the corresponding divisor rate (“n”) of each. When a counter input is greater than or equal to 80%, a Logic 1 is produced. Logic 0 signals are produced when the input drops below 75%. Counter outputs are 100% or 0%, for Logic 1 or 0, respectively.

**Output Identifications**

**FB37**
- Counter 1: 120
- Counter 2: 121
- Counter 3: 122
- Counter 4: 123

**FB38**
- Counter 1: 124
- Counter 2: 125
- Counter 3: 126
- Counter 4: 127

---

**FB37 QUAD DIVIDE BY N COUNTER #1**

- SC1N COUNTER 1 DIVISOR .... 2 to 128
- SC2N COUNTER 2 DIVISOR .... 2 to 128
- SC3N COUNTER 3 DIVISOR .... 2 to 128
- SC4N COUNTER 4 DIVISOR .... 2 to 128
- H1NA COUNTER 1 INPUT (A) .... 0 to 215
- H1NB COUNTER 2 INPUT (B) .... 0 to 215
- H1NC COUNTER 3 INPUT (C) .... 0 to 215
- H1ND COUNTER 4 INPUT (D) .... 0 to 215
- HINE RESET INPUT (E) .... 0 to 215

**FB38 QUAD DIVIDE BY N COUNTER #2**

- SC1N COUNTER 1 DIVISOR .... 2 to 128
- SC2N COUNTER 2 DIVISOR .... 2 to 128
- SC3N COUNTER 3 DIVISOR .... 2 to 128
- SC4N COUNTER 4 DIVISOR .... 2 to 128
- H1NA COUNTER 1 INPUT (A) .... 0 to 215
- H1NB COUNTER 2 INPUT (B) .... 0 to 215
- H1NC COUNTER 3 INPUT (C) .... 0 to 215
- H1ND COUNTER 4 INPUT (D) .... 0 to 215
- HINE RESET INPUT (E) .... 0 to 215

---

**Inputs**

- INPUT
- OUTPUT
- RESET
- DIVIDE BY 2

**Outputs**

- COUNTER 1
- PULSES
- DIVISOR
- COUNTER 2
- PULSES
- DIVISOR
- COUNTER 3
- PULSES
- DIVISOR
- COUNTER 4
- PULSES
- DIVISOR

**Block Diagram**
Quad One-Shot Timers #1 & #2

FB39 & FB40

Each of these blocks provide 4 single-cycle, one-shot, timers for a periodic output of a logic 1 or 0. A HOLD input to each block maintains all timers within a block at the present time. The time remaining for each timer can be displayed at the faceplate via the DISP TIMER pushbutton. The FORCE button can be used to change values if the timer is running.

Equations

IF input = logic 1 and previous cycle's input = logic 0
THEN output = logic 1 if actual on-time ≤ selected on-time
OR output = logic 0 if actual on-time > selected on-time

Output Identifications

FB39
Timer 1: 130
Timer 2: 131
Timer 3: 132
Timer 4: 133

FB40
Timer 5: 134
Timer 6: 135
Timer 7: 136
Timer 8: 137

**FB39 Quad One Shot Timer #1**

**FB40 Quad One Shot Timer #2**

**Block Diagram**
Quad Flip/Flops #1, #2 & #3

Each of these blocks provide 4 set/reset Flip/Flop logic functions to toggle an output between two states.

### TRUTH TABLE

<table>
<thead>
<tr>
<th>SET</th>
<th>RESET</th>
<th>OUTPUT FROM PREVIOUS CYCLE</th>
<th>OUTPUT</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>1</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>0</td>
<td>1</td>
</tr>
</tbody>
</table>

### Output Identifications

- **FB41**: Flip-Flop 1: 140
- **FB42**: Flip-Flop 1: 144
- **FB43**: Flip-Flop 1: 148

### Inputs

- A
- B
- C
- D
- E
- F
- G
- H

### Outputs

- FLIP/FLOP 1
- FLIP/FLOP 2
- FLIP/FLOP 3
- FLIP/FLOP 4

### Block Diagram

- **FB41**
- **FB42**
- **FB43**

---

HINA FLIP/FLOP 1 INPUT (A) ...... 0 to 215
HINB FLIP/FLOP 1 INPUT (B) ...... 0 to 215
HINC FLIP/FLOP 2 INPUT (C) ...... 0 to 215
HIND FLIP/FLOP 2 INPUT (D) ...... 0 to 215
HINE FLIP/FLOP 3 INPUT (E) ...... 0 to 215
HINF FLIP/FLOP 3 INPUT (F) ...... 0 to 215
HINS FLIP/FLOP 4 INPUT (G) ...... 0 to 215
HINH FLIP/FLOP 4 INPUT (H) ...... 0 to 215
Repeat Cycle Timer #2

This timer is available to provide an output to other blocks at selectable, repeating, timed intervals ranging up to 9999 minutes. A timer can be selectively started, stopped, or held for a specific time period as either on or off. Additionally, the “on” time can be modified with an additional input.

The time remaining can be displayed using the “DISP TIMER” button. The value can be changed via the FORCE button if the timer is running. The time cannot be forced if the adaptive input is used.

**Start**
When input B equals or exceeds 80%, the timer output goes from 0% to 100% and remains at that level for time TN. The output returns to 0% for time TF. This cycle repeats until stopped.

**Stop**
When input B drops below 75%, the timer output immediately goes to 0%.

**Adaptive On Time**
When TF = 0.0, the TIME PERIOD remains fixed (equal to TN) and ON time varies from 0 to TN as A changes from 0 to 100%. When TF is greater than 0.0, the OFF time TF remains fixed (equal to TF) and ON time varies from 0 to TN as A changes from 0 to 100%.

Configuration of this block consists of entering the required on/off times in minutes; selecting the appropriate function block output identification to start, stop, or hold the timer; and selecting the Adaptive On input to modify the on time.

**Output Identifications**
FB44: 154

---

**BLOCK DIAGRAM**

For additional Repeat Cycle Timer Function Block see FB08.
This function block allows an input to be totalized and scaled in pulses per hour (PPH). A maximum of 99999 pulses can be counted and displayed. Full scale range can be selected from 20-18,000 PPH. A zero drop-out selection allows the input to be limited to above a defined level. It causes the integrator to stop pulsing when input A drops below the ZDO setting. HI and Lo Comparators provide 100% block outputs when the HI or Lo setting is reached and a 0% output when below trip point. The totalizer can be reset when INPUT R equals or exceeds 80%. The totalizer will reset to zero and immediately start counting any pulses on the same cycle. INPUT R must fall below 75% in order to reset the counter. Additionally, a Pulse output is available to drive external counters or other blocks.

The totalizer counts and Lo & HI Comparator settings can be displayed on the 5-Digit Display via the D pushbutton. The FORCE button can be used to change comparator settings. The Lo Output Status is 0% when count is less than setting and 100% when count is greater than or equal to setting. The HI Output Status is 0% when count is less than setting and 100% when greater than or equal to setting.

Configuration of the Batch Totalizer consists of selecting the pulse input, range, zero drop-out level, comparator settings, and the reset input.

**Output Identifications**

FB45
Pulse: 155
Hi Comparator Status: 156
Lo Comparator Status: 157

For additional Batch Totalizer Function Block see FB10.
These blocks provide 3 inputs and selectable gain or bias values for a multiplied or divided output value, as required. Default values of unused inputs are set to 0%, so the associated bias should generally be set to 1.000 to ensure the unused section has a constant of 1.

Output Identifications
FB46: 160
FB47: 161

DEFAULT VALUES

<table>
<thead>
<tr>
<th>INPUTS</th>
<th>DEFAULT VALUES</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>0%</td>
</tr>
<tr>
<td>B</td>
<td>0%</td>
</tr>
<tr>
<td>C</td>
<td>0%</td>
</tr>
</tbody>
</table>

Signal Equation:

\[ S_0 = \frac{G_0 [G_A \cdot S_A + B_A]}{G_0 \cdot S_C + B_C} + B_0 \]

Where

- \( S_0 \) is the normalized output signal from the block
- \( S_A, S_B, S_C \) are the normalized value of inputs A, B & C.
- \( G_0, G_A, G_B, G_C \) are gain selections entered by user.
- \( B_0, B_A, B_B, B_C \) are bias selections entered by user.

All gains default to 1.000 and all biases default to 0.000 when not configured
If all three inputs are not used:
- When used to multiply “A” by “B”, set \( B_C = 1.00 \)
- When used to divide “A” by “C”, set \( B_B = 1.00 \).
These blocks provide 3 inputs and selectable gain or bias values for an added or subtracted output value, as required. Default values for unused inputs are set to 0%, so the associated bias should generally be set to 0.000 to ensure the unused section has a constant of 0.

Equations

\[ S_o = G_0 \times ((G_A \times S_A + B_A) \pm (G_B \times S_B + B_B) \pm (G_C \times S_C + B_C)) + B_0 \]

Output Identifications

FB46: 162  FB49: 163

Where

So is the normalized output signal from the block
SA, SB, SC are the normalized value of inputs A, B & C.
Unused inputs equal 0
G0, GA, GB & GC are gain selections entered by user.
B0, BA, BB & BC are bias selections entered by user.

All gains default to 1.000 and all biases default to 0.000 when not configured.
This function block is available to compute the difference between two inputs and multiply it by a user-selected gain value. The result can be summed as the output of the block. Configuration consists of selecting the A, B, and C inputs to the block and selecting a gain value. Default values for unconfigured input A will be set to 100% and inputs B & C to 0%.

**Equation**
Output = Gain (A-B) + C

**Output Identifications**
FB50: 164

**Block Diagram**

For additional Deviation Amplifier Function Block see FB32.
This block provides an additional square root extraction of a selected input other than the square root extraction available with FB01, FB02, & FB99. In addition, the output will be limited to 0% even if input A drops below 0%.

Output Identification
FB51: 165
This block operates similarly to a DPDT switch to allow 2 of 4 inputs to be selected by a single switch command input. Outputs will switch when a command input is greater than or equal to 80% or drops below 75%.

If inputs A and D are not configured, the default values will be set to 100% with inputs B, C, and E set to 0%.

Configuration consists of selecting the inputs to switch #1 (A & B), switch #2 (D & E), and the switch command input (C).

**Equations**

- If C < 75% then output 1 = A and output 2 = D
- If C ≥ 80% then output 1 = B and output 2 = E

**Output Identifications**

| FB52 | Switch 1: 166 | Switch 2: 167 |

For additional Dual Transfer Switch Function Block see FB33.
This function block provides a 4-20 mA dc analog output from a 0%-100% signal from other function blocks. Each block includes an additional on/off switch input that disconnects the 4-20 mA signal from the load. This switch can be used when two or more outputs are connected to the same load. Analog Output #2 (FB60) is only available with Model 382E controllers.

Configuration consists of entering the appropriate block value used as the signal output, and, if required, the block value for an on/off switch. Zero and full scale are defined during calibration of the controller. Refer to SD382 for calibration information.

Specifications
- Range: 4-20 mA
- Zero: 4.0 mA ± trim
- Span: 16 mA ± trim
- Accuracy: ±0.1% of span
- Output Load: 0-800 ohm
- Open Circuit Voltage: 25V ± 10%
- Output Current Limit: 20.5 mA ± 0.1 mA
- Switch Action: opens when INB ≥ 80%; closes when INB < 75%

Terminal Designations
- FB60: C10 (A02+)
- D10 (A0C–)

For additional Analog Output Function Block see FB03.
These blocks are configurable as either a digital, discrete input or open collector transistor digital output. When configured as output, a block will turn the transistor on when block input equals or exceeds 80% and turn the transistor off when it drops below 75%. When configured as an input, a block will turn on when the input is closed or pulled to common with an external contact or open collector transistor. The state of each configured block can be displayed via the DISP I/O button. The FORCE button can be used to change the state (on or off) of configured blocks.

NOTE: When used as an output, the function block will sense an overload condition (excessive current) and turn off to protect the output transistor. When this occurs, the DISP I/O button will display an "off" state for the function block. The block will turn on again after the overload is removed providing the block input, INA, is still high. If INA is low and the block is forced on, the overload will cancel the "force-on" state and the block will not turn on when the overload is removed.

Specifications
Input
Type: 5 Vdc, non-isolated contact or transistor input
Maximum Continuous Input: ±.30 Vdc
On/Off Time: 200 msec (minimum)

Output
Type: Open collector transistor
Voltage: 30 Vdc (maximum)
Load: 100 mA (maximum)
Off State Leakage: 200 μA

Output Identification
FB61: 170  FB69: 178
FB62: 171  FB70: 179
FB63: 172  FB71: 180
FB64: 173  FB72: 181
FB65: 174  FB73: 182
FB66: 175  FB74: 183
FB67: 176  FB75: 184
FB68: 177  FB76: 185

Terminal Designations
FB61: C2  FB69: C6
FB62: D2  FB70: D6
FB63: C3  FB71: C7
FB64: D3  FB72: D7
FB65: C4  FB73: C8
FB66: D4  FB74: D8
FB67: C5  FB75: C9
FB68: D5  FB76: D9

Common: C1, D1

See Table at left for output identification and terminal designations.
Recipe Storage and Real Time Clock

This block provides storage for up to 6 complete configurations as recipes and 4 time based 0-100% trippoint outputs. Recipes are stored, recalled, and loaded via the configuration pushbuttons on the controller. Recipe information is not altered when loading an FCO or editing a configuration. The 4 trippoints can be set at any time between 12:00 to 11:59 AM and 12:00 to 11:59 PM. When the time equals the trippoint a 100% signal occurs at the corresponding output. This 100% signal is available for one minute before returning to 0%.

Also included in this block is a Power Up Time selection. This allows a time period to be selected for the amount of time to elapse after a power interruption when the controller will resume operation at the point prior to interruption. After this time has elapsed, all timers, controller output, sequencer, etc. will be reset.

Power-Up Time Selection may be set for 0 to 19998 seconds or 19999 for an infinite time period.

The time can be displayed at the faceplate via the D (Display) pushbutton. The FORCE button can be used to change the time when the block is configured.

Output Identifications

FB77
Trippoint 1: 191
Trippoint 2: 192
Trippoint 3: 193
Trippoint 4: 194

---

**FB77 RECIPE STORAGE AND REAL TIME CLOCK**

<table>
<thead>
<tr>
<th>TRIPPOINT 1</th>
<th>191</th>
<th>12:00 AM to 11:59 PM</th>
</tr>
</thead>
<tbody>
<tr>
<td>TRIPPOINT 2</td>
<td>192</td>
<td>12:00 AM to 11:59 PM</td>
</tr>
<tr>
<td>TRIPPOINT 3</td>
<td>193</td>
<td>12:00 AM to 11:59 PM</td>
</tr>
<tr>
<td>TRIPPOINT 4</td>
<td>194</td>
<td>12:00 AM to 11:59 PM</td>
</tr>
</tbody>
</table>

**POWER-UP TIME**

0 to 19998 sec.
19999 - Infinite

---

**BLOCK DIAGRAM**

![Block Diagram](image-url)
This block is contained within the optional Local Instrument Link data communication interface available for the Model 382. The Local Instrument Link is an enhanced HDLC RS-422 serial communications protocol that can be used for communications/data transfer between a Model 382 and:

- Model 320 Independent Computer Interface
- Model 321 Expansion Satellite
- Model 324 Programmable Sequence Controller
- Model 383 Multi-Point Display Station
- Model 352 Single Loop Digital Controller
- Model 351 Triple-Loop Digital Controller

The user can select 14 variables as channel outputs to the Link. These variables are transmitted every 0.5 seconds. Up to 8 variables can be specified as inputs to the interface. These inputs are updated twice a second.

This interface also performs a number of alarm functions on signals transmitted by the Model 382 over the Link. These signals can be used by consoles, computers, etc., to provide alarm detection, logging, and acknowledgement. Transmitted and received data channel assignments for inputs and outputs of this block are listed in the following table.

Details concerning transmitted data, parameters, as well as complete interfacing details for the Model 382 and Local Instrument Link are provided in AD382-40, Model 382 Link Interface Communications User's Manual.

<table>
<thead>
<tr>
<th>Transmitted Data</th>
<th>Received Data</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input</td>
<td>Channel</td>
</tr>
<tr>
<td>L1P</td>
<td>6</td>
</tr>
<tr>
<td>L1S</td>
<td>7</td>
</tr>
<tr>
<td>L1V</td>
<td>8</td>
</tr>
<tr>
<td>INA</td>
<td>45</td>
</tr>
<tr>
<td>INB</td>
<td>46</td>
</tr>
<tr>
<td>INC</td>
<td>47</td>
</tr>
<tr>
<td>IND</td>
<td>48</td>
</tr>
<tr>
<td>Output</td>
<td>Channel</td>
</tr>
<tr>
<td>200</td>
<td>56</td>
</tr>
<tr>
<td>201</td>
<td>57</td>
</tr>
<tr>
<td>202</td>
<td>58</td>
</tr>
<tr>
<td>203</td>
<td>59</td>
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<tr>
<td>204</td>
<td>60</td>
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<tr>
<td>205</td>
<td>61</td>
</tr>
<tr>
<td>206</td>
<td>62</td>
</tr>
<tr>
<td>207</td>
<td>63</td>
</tr>
</tbody>
</table>

(continued on next page)
Local Instrument Link Interface

**FB88 LINK INTERFACE**

- **LINK STATION ADDRESS** 0 to 64
- **LOOP 1 PROCESS** 0 to 215
- **LOOP 1 LIMITS (SETPPOINT)** No/Yes
- **LOOP 1 SETPOINT** 0 to 215
- **LOOP 1 VALVE** 0 to 215
- **INPUT A** 0 to 215
- **INPUT B** 0 to 215
- **INPUT C** 0 to 215
- **INPUT D** 0 to 215
- **INPUT E** 0 to 215
- **INPUT F** 0 to 215
- **INPUT G** 0 to 215
- **INPUT H** 0 to 215
- **INPUT I** 0 to 215
- **INPUT J** 0 to 215
- **INPUT K** 0 to 215

**H I N L**
- **EMERGENCY LOCAL INPUT** 0 to 215
- **SOURCE ADDRESS. OUTPUT 200** 0 to 64
- **SOURCE CHANNEL. OUTPUT 200** 0 to 256
- **SOURCE ADDRESS. OUTPUT 201** 0 to 64
- **SOURCE CHANNEL. OUTPUT 201** 0 to 256
- **SOURCE ADDRESS. OUTPUT 202** 0 to 64
- **SOURCE CHANNEL. OUTPUT 202** 0 to 256
- **SOURCE ADDRESS. OUTPUT 203** 0 to 64
- **SOURCE CHANNEL. OUTPUT 203** 0 to 256
- **SOURCE ADDRESS. OUTPUT 204** 0 to 64
- **SOURCE CHANNEL. OUTPUT 204** 0 to 256
- **SOURCE ADDRESS. OUTPUT 205** 0 to 64
- **SOURCE CHANNEL. OUTPUT 205** 0 to 256
- **SOURCE ADDRESS. OUTPUT 206** 0 to 64
- **SOURCE CHANNEL. OUTPUT 206** 0 to 256
- **SOURCE ADDRESS. OUTPUT 207** 0 to 64
- **SOURCE CHANNEL. OUTPUT 207** 0 to 256

**NOTE:** NUI - Non-Updating Input

**LOCAL INSTRUMENT LINK PARAMETERS (EXTERNAL)**

The following Model 382 information are configuration parameters for external devices of a Local Instrument Link (e.g., computers, control consoles, etc.). These parameters cannot be configured at the faceplate of the Model 382.

**C I D**
- **CONFIG IDENTIFICATION** 12 char. (ASCII)

**D R N**
- **DATA BASE REVISION NUMBER** 0 to 32767

**L A M**
- **MIMIC LOOP ALARMS** Yes/No
- **LOOP ALARM #1 LIMIT** 0.0 to 100.0%
- **LOOP ALARM #2 LIMIT** 0.0 to 100.0%
- **LOOP ALARM #3 LIMIT** 0.0 to 100.0%
- **LOOP ALARM #4 LIMIT** 0.0 to 100.0%
- **LOOP ALARM #1 TYPE** ATW
- **LOOP ALARM #2 TYPE** ATW
- **LOOP ALARM #3 TYPE** ATW
- **LOOP ALARM #4 TYPE** ATW

ATW — alarm type word is a 12 bit word that defines the alarm type. Details on each type word can be found in the Model 382 — Link Communications User's Manual A0382-40.
Function Block FB99 is reserved for a third, optional input for the Model 382 and can be selected for:

- Voltage
- Computer Pulse
- Millivolt or Thermocouple
- RTD
- Frequency

The following pages list information about each of these function blocks.

**NOTE:** These function blocks include default configuration parameters that may differ from default parameters of other blocks. It is important to check and/or change all default parameters of FB99 after installation of an optional input board or any time an FCO is stored.
This function block converts an analog voltage with a range defined during calibration into a 0-100% block output for interconnection to other function blocks.

Also included is a digital filter than can be used to filter out process noise and a square root extractor for linearizing a flow signal from a ΔP transmitter.

 Calibration details can be found in Instruction SD382 which is included in Section 4 of this manual.

Specifications
Type: Single-ended
Accuracy: 0.05%
Zero and Span: 0 to 1.0 Vdc and 4 to 5 Vdc
Normal Mode Rejection: 6 db at 2 Hz, 60 db at 60 Hz
Input Impedance: Greater than 1 meg ohm
Max. Continuous Input: ±30 Vdc

Temperature Effect: less than ±0.5% change in span in a 100°F ambient

Output Identification
FB99: 33

Terminal Designations
FB99: A13+ (A10)
A13e- (A9)

Block Diagram
Optional Input, Computer Pulse

Applications such as Computer-Set Supervisory, Direct Digital Control (DDC), etc. can be implemented with a Model 382 with this optional input board and function block. This block provides a 0-100% output to other blocks upon an incoming pulse. The output can be incremented either up or down by input pulses which can be selected with hardware jumper plugs for either Dual Pulse or Pulse Direction formats. The block output can also be made to track input T when input C goes high.

Configuration consists of selecting the hardware jumper on the board for either Dual Pulse or Pulse Direction, determining full scale pulses, and selecting the Track (T) and Track Command inputs.

Specifications
Input Voltage: ON = 5-30 Vdc, OFF ≤ 0.5 Vdc
Max. Frequency: 5000 Hz
Min. Pulse Width: 100 msec.
Isolation: Input to be isolated up to 100 Vdc from station common
Maximum Continuous Input: ±30 Vdc
Temperature Effect: less than ±0.5% change in span in a 100°F ambient

Output Identification
FB99: 33

Terminal Designations
FB99: A13+ (A10)
A13− (B10)
A13e (A9)

---

(continued on next page)
Optional Input, Millivolt/Thermocouple

This function block converts a low level analog voltage (millivolt/thermocouple) into a 0-100% block output for interconnection to other function blocks.

There are two hardware jumpers on the PCB board. J1 determines if the range is wide (allows CI3T selections 1-4) or narrow (allows CI3T selections 5-9). J2 selects UPSCALE or DOWNSCALE drive on an open circuit input.

Once the hardware jumpers have been selected a range type can be picked in the calibration configuration mode CI3T. The input would then be calibrated for the range type selected. (e.g., if 2 (J) is picked the input would be calibrated for a thermocouple range of 0-1700°F). Details on calibration can be found in Instruction SD382 included in Section 4 of this manual.

A unique feature of this input card is the highly accurate 16-bit autoscaling A/D Converter. Since the block output of 0-100% is represented by a 12-bit value, the user can select, during the configuration, the actual millivolt range to be represented by the 0-100% 12-bit value.

Output Identification
FB99: 33

Terminal Designations
FB99: A13+ (A10)  
A13- (B10)

Sensor Board (A8)  

<table>
<thead>
<tr>
<th>COIL</th>
<th>CI3T</th>
<th>CI3R</th>
<th>CI3T</th>
<th>CI3R</th>
<th>SPAN RANGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1(M0)</td>
<td>0.00 MV</td>
<td>250 MV</td>
<td>250 MV</td>
<td>75.00 to 75.00 MV</td>
<td>75.00 to 75.00 MV</td>
</tr>
<tr>
<td>2(M1)</td>
<td>0°F</td>
<td>10°F</td>
<td>10°F</td>
<td>-250°F to 250°F</td>
<td>-250°F to 250°F</td>
</tr>
<tr>
<td>3(M2)</td>
<td>0°F</td>
<td>10°F</td>
<td>10°F</td>
<td>-250°F to 250°F</td>
<td>-250°F to 250°F</td>
</tr>
<tr>
<td>4(M3)</td>
<td>0°F</td>
<td>10°F</td>
<td>10°F</td>
<td>-250°F to 250°F</td>
<td>-250°F to 250°F</td>
</tr>
<tr>
<td>5(M4)</td>
<td>0.00 MV</td>
<td>25.00 MV</td>
<td>25.00 MV</td>
<td>25.00 to 25.00 MV</td>
<td>25.00 to 25.00 MV</td>
</tr>
</tbody>
</table>

† Used with Computer Pulse Input only

* Range Table

* 300 to 750°F (150 to 400°C) for all software releases prior to release BB5.
This function block converts a resistance range from a Platinum RTD to a 0-100% block output for interconnection to other blocks.

The RTD input is linearized using either the DIN or US curves. A unique feature of this input card is the highly accurate 16-bit autoscaling A/D converter. Since the block output of 0-100% is represented by a 12-bit value, the user can select during soft configuration the actual resistance range to be represented by the 0-100% 12-bit value.

Specifications
Type: 100 Ohms. Platinum, DIN or US
Range Limits: -300°F to 1200°F (-185°C to 650°C)
Range Low: -300°F to 800°F (-185°C to 425°C)
Range High: -275°F to 1200°F (-171°C to 650°C)
Lead Resistance Effect: 0.0°F/Ohm
Accuracy: ±0.1% of span for a > 100°F;
±0.1°F for a span < 100°F

Output Identification
FB99: 33

Terminal Designations
FB99: A13+ (A10)
A13– (B10)
A13e (A9)

---

**FB99 OPTIONAL INPUT, RTD**

<table>
<thead>
<tr>
<th>Specification</th>
<th>Setting</th>
</tr>
</thead>
<tbody>
<tr>
<td>FILTER BREAKPOINT FREQ.</td>
<td>0.001 to 10.00 Hz</td>
</tr>
<tr>
<td>RANGE TYPE</td>
<td>DIN/US</td>
</tr>
<tr>
<td>RANGE UNITS (°F/°C)</td>
<td>F/C</td>
</tr>
<tr>
<td>RANGE LOW</td>
<td>(1)</td>
</tr>
<tr>
<td>RANGE HIGH</td>
<td>(2)</td>
</tr>
<tr>
<td>ZERO INPUT</td>
<td>100.0 ohms</td>
</tr>
<tr>
<td>FULL SCALE INPUT</td>
<td>200.0 ohms</td>
</tr>
<tr>
<td>VERIFY INPUT</td>
<td>-3.3 to 103.3%</td>
</tr>
<tr>
<td>INPUT T</td>
<td>0 to 99</td>
</tr>
<tr>
<td>INPUT C</td>
<td>0 to 99</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Note</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1)</td>
<td>SRL; -300 to 800°F (-185 to 425°C)</td>
</tr>
<tr>
<td>(2)</td>
<td>SRH; -275 to 1200°F (-171 to 650°C)</td>
</tr>
</tbody>
</table>

---

**BLOCK DIAGRAM**

(continued on next page)
Frequency inputs to a Model 382 can be implemented with this optional input board and function block. This input can accept sine, square, pulse, or triangle waveforms at frequencies between 0.05 Hz and 25.0 KHz with amplitudes from 4.0V to 60.0V, peak-to-peak. It can also accept contact closure inputs at a maximum frequency of 100 Hz.

The input frequency is converted to a 0-100% value for use by other blocks. The Frequency Input block features a selectable LEARN mode to determine waveform peak and valley, or direct entry when these values are known. When LEARN is selected, the board automatically samples the input to set the CIPV and CIVV parameters. Input peak and valley, as well as the LEARN selection, are defined during calibration of the controller. Refer to SD382 for calibration information.

Configuration consists of selecting the minimum and maximum frequency ranges, zero dropout percent of range, and using the block's output identification as an input to other blocks.

Specifications
Frequency Range: 0-1 Hz to 0-25,000 Hz
Zero: 0-10,000 Hz
Span: 1-25,000 Hz (span must be greater than 1X zero frequency)
Operating Frequency: 0.05 Hz (minimum)
Signal Types: Sine, Square, Pulse, Triangle, or Contact Closure
Pulse Width: 20.0 μsec (minimum)
Signal Amplitude: 4-60 Vac, peak-to-peak
Note: The DC offset voltage plus 0.5 times the peak-to-peak AC voltage cannot exceed 30V.

Output Identification
FB99: 33

Terminal Designations
FB99: A13+ (A10)
A13 (B10)

---

**BLOCK DIAGRAM**

(continued on next page)