

**FEATURES**

- Jumper selectable analog input
- Jumper selectable output pulse timing
- Two 24VAC 3 point floating Triac outputs
- Dual pipe system change over option

**APPLICATIONS**

- 0-20 mA 3 point floating
- 0-10VDC to 3 point floating
- Phase cut to 3 point floating
- Dual 3 point floating damper or valve operation

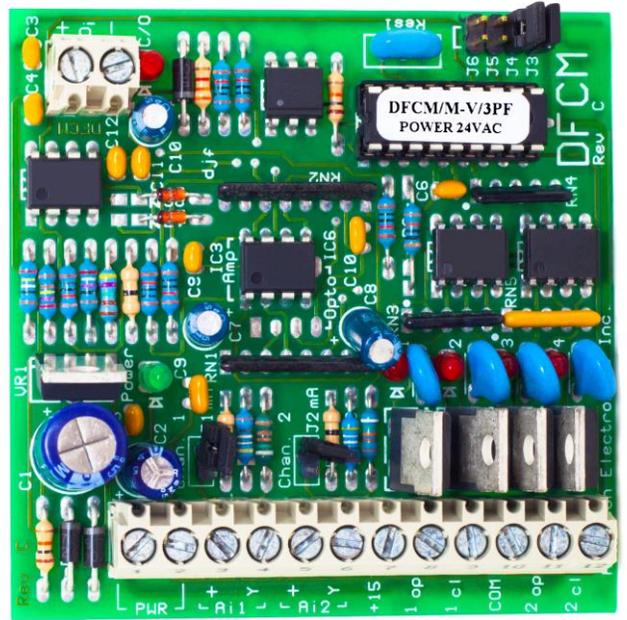
**DESCRIPTION & OPERATION**

The DFCM is a 2 channel analog to 3 point floating controller module. It's available in two versions; voltage and milliamp input to 3 point floating 24VAC Triac outputs, and phase cut input to 3 point floating 24VAC Triac outputs. The DFCM has two output time bases for each of the independent 3 point floating outputs. The DFCM uses state of the art micro controller technology that provides superior system performance. The DFCM is useful when interfacing to 3 point floating damper actuators, valves, or other 3 point floating input devices.

The DFCM's 24VAC input uses a half-wave rectifier configuration, which is filtered and regulated to provide power for the on-board circuitry and to supply a 15VDC reference voltage on terminal 7. The DFCM uses an embedded micro controller to interpret the input signals and provide a corresponding 3 point floating output signals. The analog inputs may be configured to accept 0-10VDC or 0-20mA by making a jumper selection on the voltage version. The phase cut version accepts a 10-90% phase cut signal. The 3 point floating output signals can be configured for either of two time bases, 60 or 120 seconds, for 2 and 5 minute actuators.

The DFCM scales the analog input signal to 0 to 5VDC for the micro controller. It is then processed digitally and a 3 point floating output signal is generated. The 3 point floating output floating is updated every 30 seconds, and a 100% input will result in a pulse that is 25% of the selected time base.

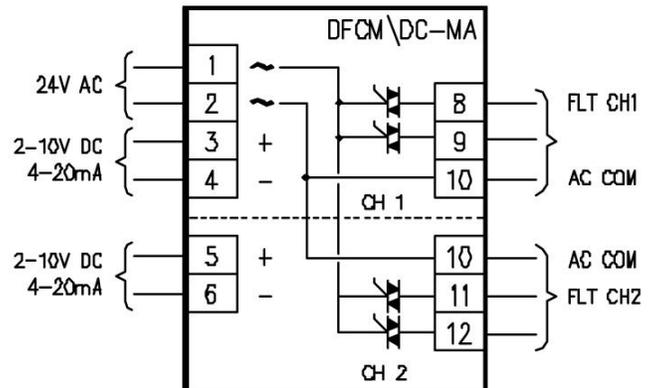
Example: input signal is 0-10VDC, 60 second output time base is selected. With a 0V input signal applied, the output calculation will result in a 100% call to drive closed (15 seconds pulse every 30 seconds), a 2.5V input will result in a 50% calculation (7.5 seconds pulse).



**SPECIFICATIONS**

SIZE:	2.75"L x 3"W x 1.1"H
MOUNTING:	3" RDI Snap track (supplied)
POWER:	24VAC ± 10%, 50/60Hz, 2VA
INPUT:	10-90% phase cut 0-10VDC non-isolated 4-20mA non-isolated
OUTPUT RATINGS:	24VAC Triac @ 4 Amps

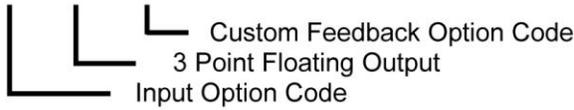
**WIRING CONFIGURATION**



ORDERING INFORMATION

PHYSICAL CONFIGURATION

DFCM/XXX/3PF/XXX

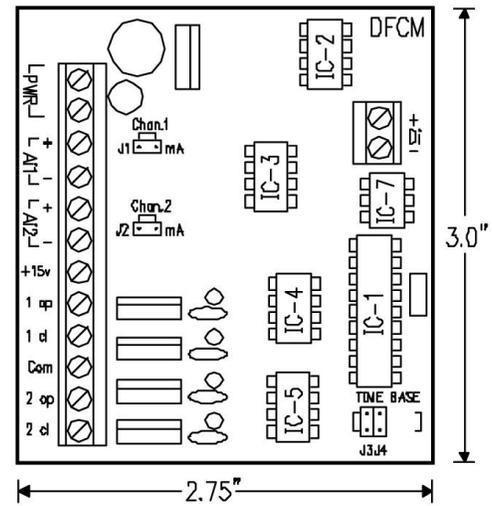


INPUT CODE OPTIONS

V-mA	0-10VDC, 0-20mA inputs
PC	10-90% phase cut, (isolated)

CUSTOM FEEDBACK CODE OPTIONS

ICO	Isolated change over input option (24VAC Di)
FB10	0-10VDC feedback option. (V-mA input only)
FBP	Potentiometer feedback option *specify resistance



JUPER DEFINITION

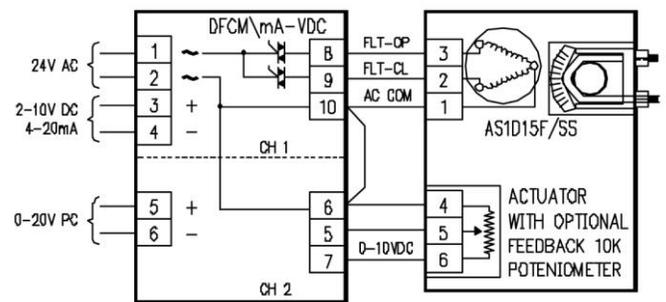
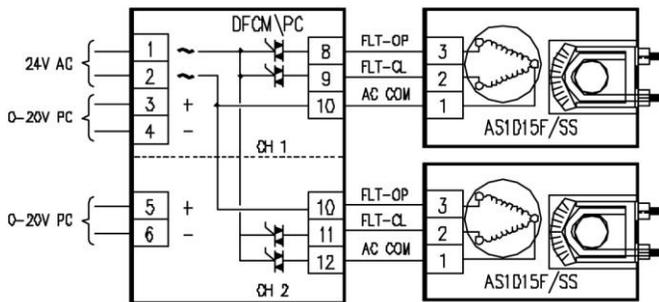
- J1 - Channel 1 voltage & mA input selection jumper. (Open – 0-10V, Closed – 0-20mA input).
- J2 - Channel 2 voltage & mA input selection jumper. (Open – 0-10V, Closed – 0-20mA input).
- J3 - Channel 1 output time base. (Open - 60 second base, max. 15 second pulse. Close - 120 second base, max. 30 seconds pulse).
- J4 - Channel 2 output time base. (Open - 60 second base, max. 15 second pulse. Close - 120 second base, max. 30 seconds pulse).
- J5 - Feedback option, Ai2 becomes the feedback input, single 3 point floating output (V-mA input option only).
- J6 - Change over option, channel 2's output controlled by channel 1's input and will track channel 1's output (same as ICO).

ORDERING CODE EXAMPLES

- DFCM/V-mA – 0-10VDC or 0-20mA input to 24VAC 3 point floating output.
- DFCM/PC – 10-90% phase cut input to 24VAC 3 point floating output.
- DFCM/PC/ICO – 10-90% phase cut input with optional isolated change-over input.

TYPICAL PHASE CUT APPLICATION

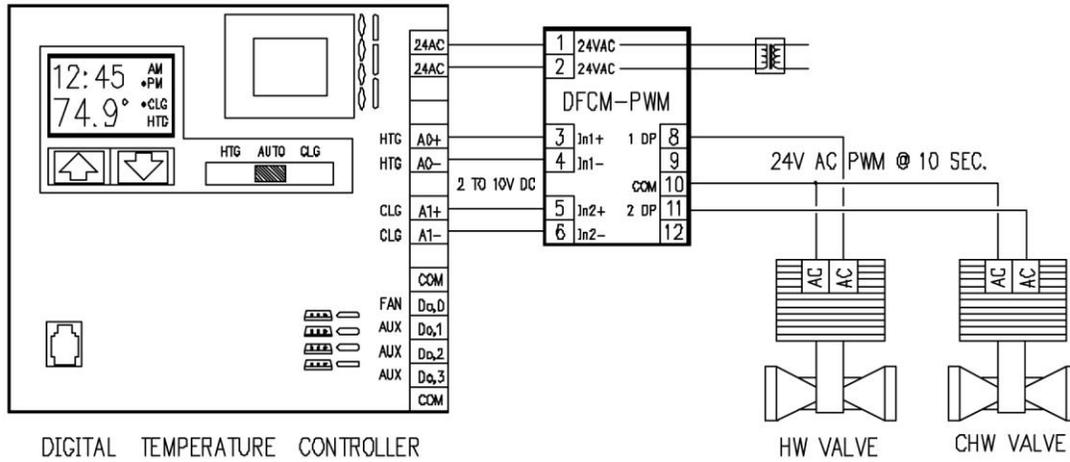
TYPICAL FEEDBACK APPLICATION



The DFCM/PC uses two logic Triacs per channel to switch the open/close 24VAC outputs. The DFCM's output can be jumper configured for one of two output time bases to fit your actuator or valve requirements.

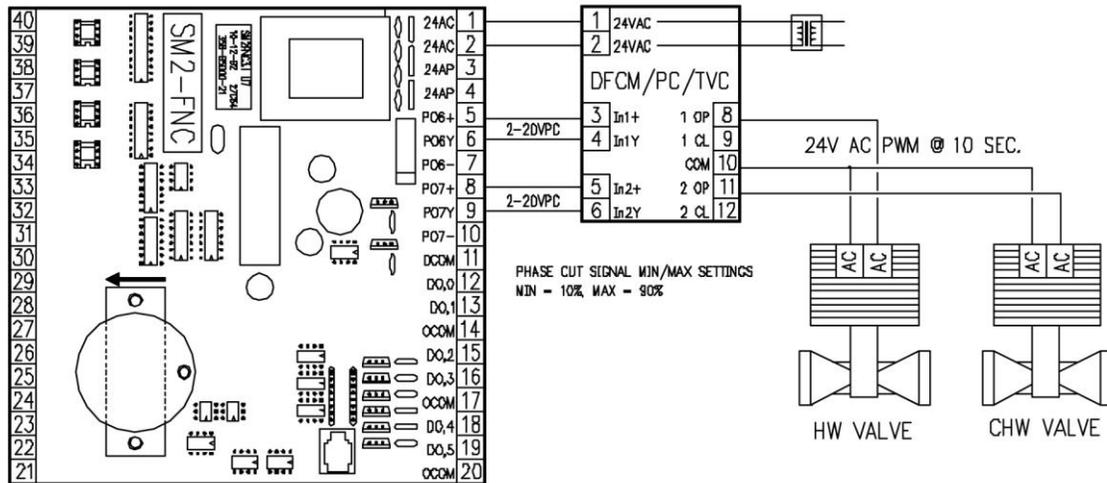
The DFCM/V-mA can be configured for feedback operation by inserting a jumper on J5. The channel 2 input Ai2 serves as the input for the feedback signal, a series resistor is used to bias the 10k Ohm potentiometer for a 0-10VDC.

**APPLICATION 1**  
**DUAL ANALOG INPUT TO DUAL THREE POINT FLOATING OUTPUT**



The DFCM/ V-mA is used to convert an analog input signal to a 3 point floating (FLT) output. Select the jumper for the desired input for each channel, 0-10VDC (J1, J2 are open), or 0-20mA (J1, J2 are closed). The DFCM outputs uses a set of Triacs for each channel, rated @ 4 Amps, to switch the 24VAC. The output is updated every 30 seconds. The output time base selected will determine the length of each adjustment pulse within that 30 second window (Ch1-J3, Ch2-J4). A 100% call for adjustment will give a 25% of the output time base selected. For example if the controller is giving a 7.5VDC output, and the time base jumper is closed, then a proportional output pulse will be 12.5% of the output time base selected. See the *FIELD SETUP AND CALIBRATION*.

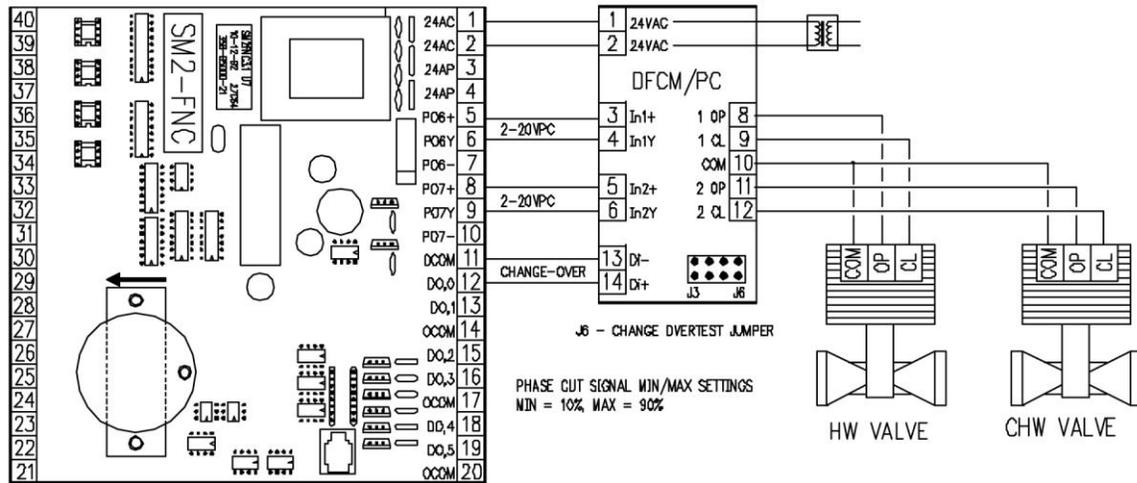
**APPLICATION 2**  
**DUAL PHASE CUT INPUT TO DUAL THREE POINT FLOATING OUTPUT**



The DFCM/PC is used to convert a 10-90% phase cut signal to a 3 point floating (FLT) output signal. A phase cut input configuration is factory configured. The DFCM outputs uses a set of Triacs for each channel, rated @ 4 Amps to switch the 24VAC. The output pulse is updated every 30 seconds. The output time base selected will determine the length of each adjustment pulse within that 30 second window. A 100% call for adjustment will give a 25% of the time base selected. For example if the controller is giving a 7.5VDC output, and the time base jumper is closed (120 seconds) then a proportional output pulse will be 12.5% of the output time base selected (15 seconds). See *FIELD SETUP AND CALIBRATION*.

APPLICATION 3

PHASE CUT INPUT TO THREE POINT FLOATING OUTPUT WITH CHANGE OVER OPTIONS



The DFCM/PC/ICO is used to convert a 10-90% phase cut signal to a 3 point floating (FLT) output signal. A phase cut input configuration is factory configured. The DFCM outputs uses a set of Triacs for each channel, rated @ 4 Amps to switch the 24VAC. The seasonal change over option (ICO) accepts a 24VAC digital signal from a Smart II DO. It instructs the DFCM program to look at channel 1's input for processing for both channel 1 & 2 3 point floating outputs. Thus the channel 2's 3 point floating output tracks the 3 point floating output of channel 1. J6 allows field test of change-over option. See *FIELD SETUP AND CALIBRATION*.

**DESCRIPTION OF OPERATION**

The DFCM is a two channel analog to 3 point floating controller module. It uses a state of the art micro controller technology to process the input signal for each channel and provide a pulsed 3 point floating output for each channel. The DFCM's dual 3 point floating (FLT) outputs will be updated at the end of each 30 second period. The output pulse for each channel will be based on a calculation of its input signal in relation to center position (50%), and on an assumed position of the control element. The DFCM will be trying to maintain a 50% input signal. Any adjustment requirement above 50% will pulse the open output proportionally. Conversely, any input signal below 50% will pulse the close output proportionately. The output time base selected will determine the output pulse length. (See time base jumper section). A 100% call for adjustment will provide 25% of the output time base selected. For example, if the 120 second output time base is selected, and a 100% call for adjustment is required, the output pulse length will be 29.5 seconds. The output is non-latching, that is to say, that it will never remain ON for the entire period. There will always be a short OFF pulse when a 100% input is applied. If the 60 second output time base is selected and the same 100% request is made, the output pulse length will be 15 seconds. This allows the DFCM to peck its way into the set point without overshooting.

**INPUT SELECTION JUMPER**

The DFCM has a single position jumper located just right of the input terminal for each input. These jumpers allow you to select between a 0-10VDC or 0-20mA input signal. Jumper J1 selects the input type for Ai1 (terminals 3 & 4), jumper J2 selects the input type for Ai2 (terminals 5 & 6). When J1 or J2 is closed (jumpered with shorting shunt), it connects in a 250 Ohm load resistor for a 0-20 mA signal.

1. For an analog input of 0-10VDC, the jumper must be left open.
2. For an analog input of 0-20 mA, the jumper must be closed (marked mA).

**TIME BASE SELECTION JUMPERS**

The DFCM's output section has a single time base selection jumper (located in the lower right corner of the DFCM board), for each channel. These jumpers allow you to select between two time bases: 60 seconds and 120 seconds. Jumper J3 selects the time base for channel 1, and J4 selects the time base for channel 2. The DFCM update window occurs every 30 seconds and the output pulse length is based on the input signal and time base selected. Example: If a 100% call to drive either open or closed, the resulting output pulse length will be either 15 seconds or 29.5 seconds depending on selected time base.

1. For a maximum 15 second pulse length, the jumper must be left open.
2. For a maximum 29.5 second pulse length, the jumper must be closed.

Example: Channel 1 is set of voltage operation (J1 open) with an input voltage of 7.5V applied. The time base selected is 120 second (J3 closed). The maximum output pulse will be 15 seconds. See formula below.

$$\frac{(\text{Input voltage} - 5\text{v})}{5\text{v}} \times (.25 \times \text{time base selected}) = \text{pulse length in second}$$

$$\frac{(7.5\text{v} - 5\text{v})}{5\text{v}} \times (.25 \times 120) = 15 \text{ seconds every 30 second window}$$

Note: If value is positive output will drive open, if negative output will drive closed.

**FEEDBACK OPTIONS**

The DFCM/V-mA/FB10 is configured for either 0-10VDC or 4-20mA feedback signal to be fed into channel 2's input (Ai2). The compares the two input signals and sends the appropriate adjustment signal to the output. Channel 2's output remains inactive in feedback mode.

The DFCM/V-mA/FBP is configured for a feedback potentiometer input on channel 2 (Ai2), the resistance of the pot should be specified when ordering. A resistor is placed in series with the +15V supply and terminal #7 (R39) for the specific resistance of the pot. The pot connects between terminals 7 (+15V) & 10 (Com) with the wiper connecting to terminal 5 (Ai2+).

If using a standard DFCM/V-mA a wire jumper must be connected between terminal 6 (Ai2-) and 10 (Com), and a series resistor must be added between terminal 7 (+15V) and the potentiometer. The following formula is used to calculate series resistor value:

$$[(\text{Pot resistance} \times 10\text{k}) \div (\text{Pot resistance} + 10\text{k})] \div 2 = \text{Resistor value. } [(5\text{k} \times 10\text{k}) \div (5\text{k} + 10\text{k})] \div 2 = 1.67\text{k Ohm.}$$