ADDITIONAL
Safety
Equipment

Failsafe Start Relay

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1. Scope

The Fail Safe Start Relay is designed to provide a failsafe starting architecture for motor contactors driven from a logic signal which can be prone to failure and give rise to dangerous conditions.

Typical application is where Programmable Logic Controller's (PLC's) are used and the possibility of a "freeze" condition whereby the PLC ceases to cycle and results in outputs being locked in the high state gives rise to these dangerous conditions. (No control anymore)

These conditions must be prevented at all costs due to risk of ignition of dangerous gasses and/or injury to personnel.

2. Overview

Reducing and/or eliminating these risks, a failsafe method of activating circuits are required.

To accomplish this, the Failsafe Start Relay (FSR) is designed to accept 24 Vdc Input pulses from a PLC or similar device at a pre-programmed frequency.
If these pulses were to fail to

- a high state,
- low state, or
- an abnormal frequency, the output relays will not energise.

Since the recognition of these pulses is done via a microprocessor the internal architecture of the FSR has been itself configured to de-energise the output relays in the event of failure of the microprocessor or any other component. (Failsafe)

This internal architecture does not rely on programming of the microprocessor but is dependent on the configuration and the physical characteristics of the components employed.

The FSR has two channels which can be used independently.

- Each channel can be programmed to accept a different input frequency or the two channels can be configured to run from one input signal by feeding the same signal into PLC1 and PLC2 input connection.
- Both channels will still require programming for the desired input signal.

3. IMPORTANT NOTE

The FSR safety circuit is not to be used as an isolation circuit. Correct isolation procedures to isolate and lockout the PowerCentre to work on the PowerCentre system (Including field equipment) must be followed.

Note: *Although no belt drive circuit will operate if no healthy pulse signal is detected, it cannot be regarded as a lockout circuit. These pulse signals are only used in this application to start belt drive circuits via the onboard PLC safely. Belt drive circuits can start at any time should the programming allow it. Pre-Start-Alarms are the responsibility of the End-User and must at all times warn personnel of equipment being energized*.

4. Operation

To ensure that FSR will operate only on an actual input signal, the operating bandwidth has been limited to a specific frequency range. (4Hz to 40Hz) All input frequencies outside this range will not be recognized by the FSR.

Therefore,

- The FSR cannot learn an input frequency lower than 4 hertz or greater than 40 hertz.
- The unit will trip if the frequency goes above 45Hz even if it is still within the 30% frequency tolerance, detailed below.

Note: *As an extra safety measure a 50% duty cycle is not accepted by the FSR, which adds an extra degree of protection against operational pulse substitution. The duty cycle of the pulse has a maximum mark (ON/High) to space (OFF/Low) ratio of 40 /60 % or vice versa.*

This is done in particular to avoid any unintended activation from pulse synthesis from potential connections to the 50Hz (or 60Hz) mains supply, from induced voltages from the same supply or by manual bypass.

Input frequencies can be programmed into each of the channels by applying the desired pulse train to each input and then following the programming procedure under item 5.

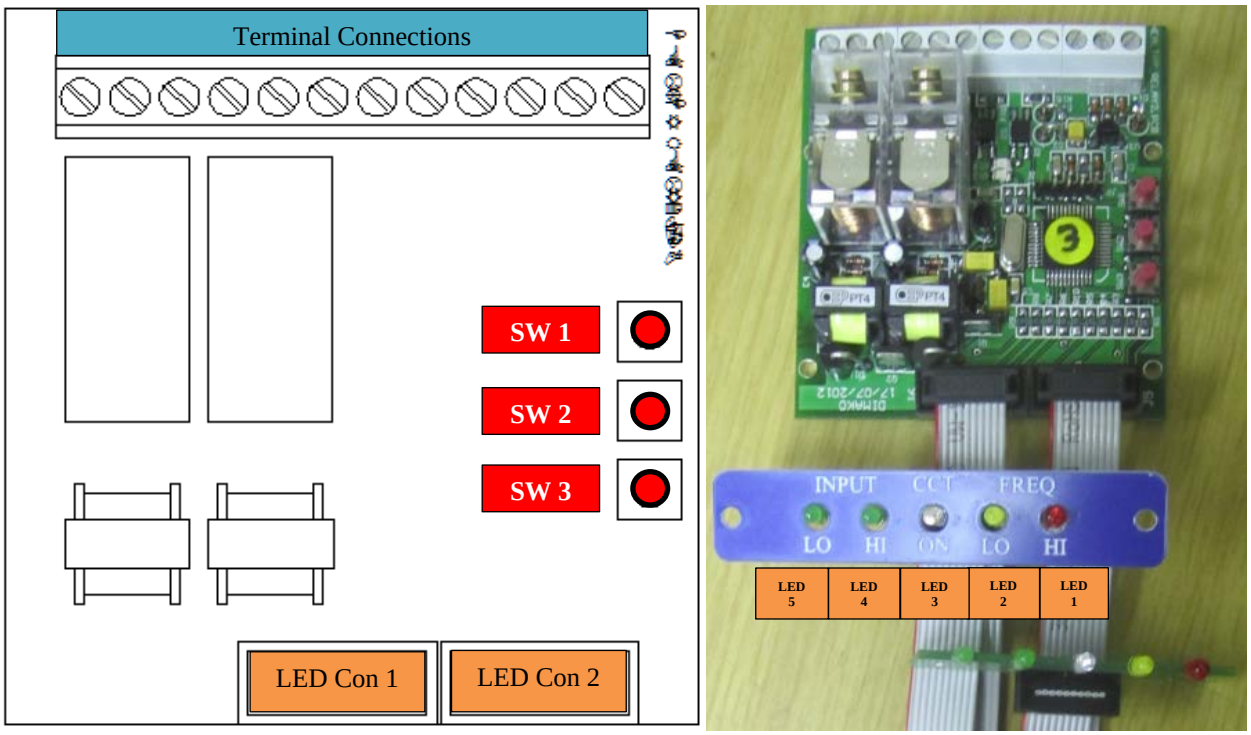
Set Frequency deviation

Once an input frequency is programmed into the unit, a +/- 30% variation is allowed on the pulse widths, to avoid nuisance tripping as a result of deviations in PLC cycle times.

The FSR has two LED indication PCBs which give the user operational feedback.

LED Number	Color Indication	Description
LED 1	RED	Input Frequency too High
LED 2	Yellow	Input Frequency too Low
LED 3	Blue	Frequency Healthy and Relay ON
LED 4	Green	"On" when Pulse Input High Voltage (24Vdc)
LED 5	Green	"On" when Pulse Input Low Voltage (0Vdc)

Note: *During operation, LED1 and 2 may flash indicating a variation on the input pulse but as long as the corresponding relay (1 or 2) remains energised and the LED3 is ON, then the variation is within acceptable limits.*

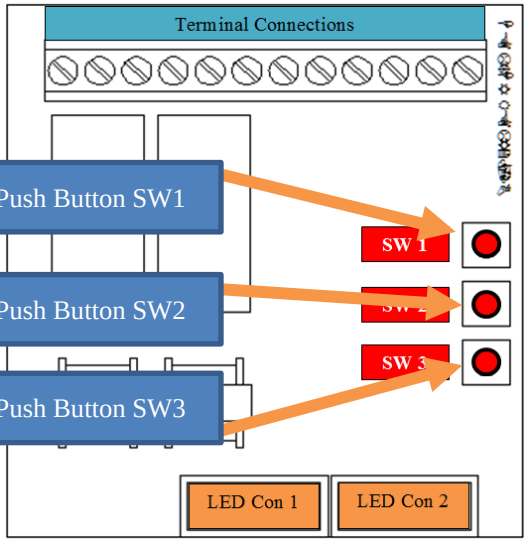


Drawing and Photo of the FSR Layout and PCB

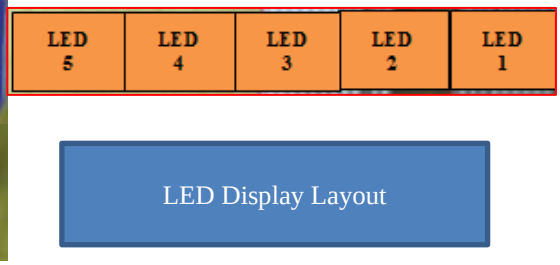
5. Programming Procedure

There are Two Relays per FSR which can be independently programmed.

Photo of FSR PCB



Drawing of FSR PCB Layout



Photos of LED Indication Displays

Relay 1:

The programmer must have a view of the corresponding indication board to ensure the proper sequence is followed

1. With the desired pulse train applied to Input PLC1, LEDs 4 and 5 should light alternately. If the pulse train is greater than 10Hz this might not be distinguishable and the LEDS may appear to flash.

2. Press Push Buttons SW3 and SW2 simultaneously and keep pressed (for about 6 Seconds).

3. After the period in step 1 LED1 will switch ON and LEDs 4 and 5 will Switch OFF.

4. Keep Pressing Push Button SW 2 and press Push Button SW3….. 6 or 7 times…. **Until LEDs** 3 and 5 light up indicating a "successful Learn".

5. If this does not happen and
   - LED 4 Lights up ➔ then the duty cycle is out of range
   - LEDs 4 and 5 Light up ➔ then the frequency is below 4Hz or above 40Hz.
   - LED 3 lights up ➔then the FSR cannot detect five stable frequency cycles within an acceptable range.

Relay 2:

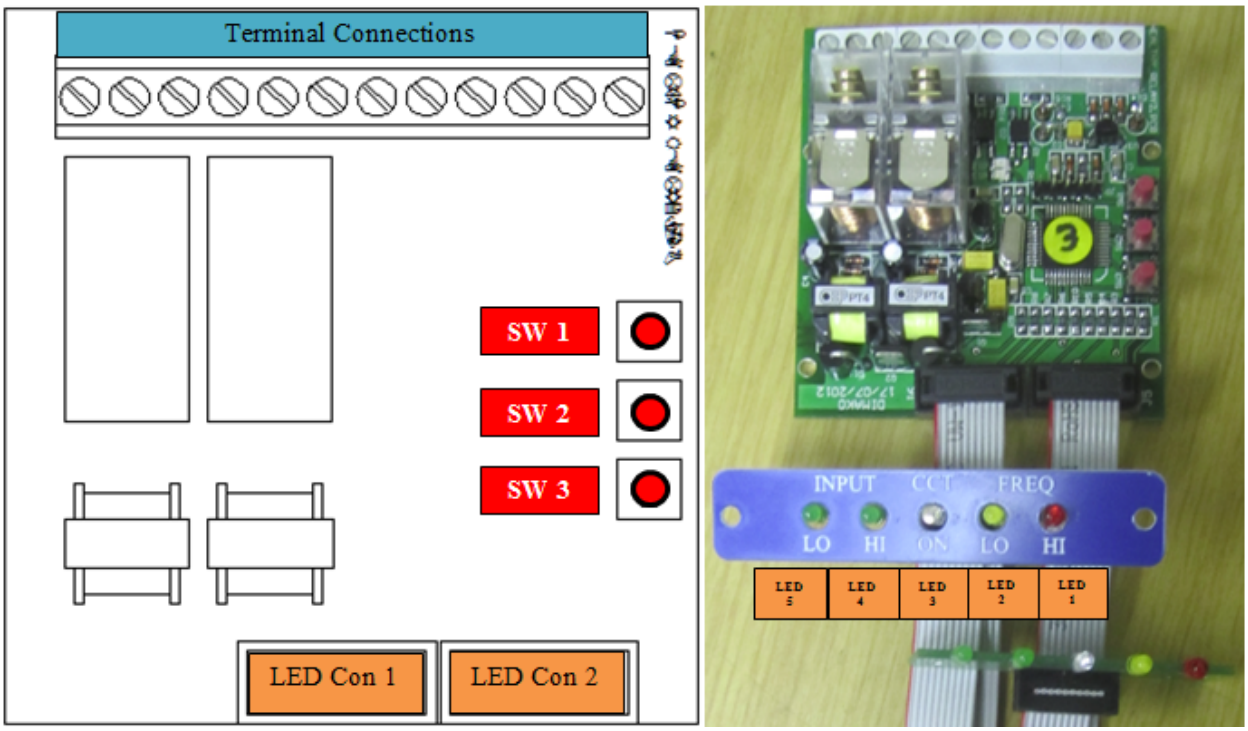
1. With the desired pulse train applied to Input PLC2 LEDs 4 and 5 should light alternately. If the pulse train is greater than 10Hz this might not be distinguishable and the LEDS may appear to flash.

2. Press Push Button SW1 and 2 simultaneously and keep pressed (for about 6 Seconds).

3. After the period in step 1 LED1 will switch ON and LED4 and 5 will Switch OFF.

4. Keep Pressing Push Button SW 2 and press Push Button SW1….. 6 or 7 times…. **Until LEDs** 3 and 5 light up indicating a "successful Learn".

5. If this does not happen and
   - LED 4 Lights up ➔then the duty cycle is out of range
   - LEDs 4 and 5 Light up ➔then the frequency is below 4Hz or above 40Hz.
   - LED 3 lights up ➔then the FSR cannot detect five stable frequency cycles within an acceptable range.



Drawing and Photo of FSR Layout and PCB

Note

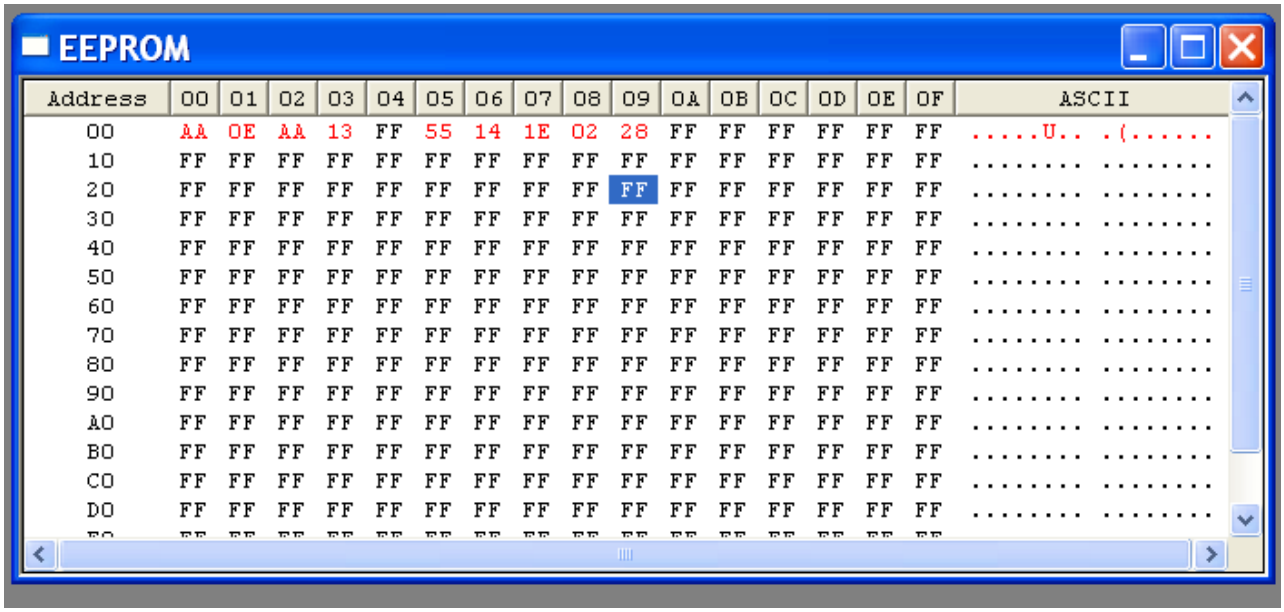
The Instruction from Anglo American C&I for the Power Centres is that the PLC control Pulse for Motor Starting shall have a 50mSec ON time and 30mSec OFF time. This applies to all motors.

Dimako Propriety Annexure A

Firmware Version:

Healthy relay EEPROM

EEPROM File



Address NO:	Description
00	Do not change. This is the pointer for relay 1 'learn' valid.
01	The learned frequency for relay 1. This value is the high time in milliseconds plus the low time in milliseconds divided by two. The average of five cycles is taken. Do not change
02	Do not change. This is the pointer for relay 2 'learn' valid
03	The learned frequency for relay 2. This value is the high time in milliseconds plus the low time in milliseconds divided by two. The average of five cycles is taken. Do not change.
04	
05	This is the pointer for valid data in 06 to 09. The CPU writes the default values in this position if not changed.
06	This value is the HEX percentage for the frequency 'learn' cycle. This value is also used for the switch on threshold of the relays. This value must always be smaller as the value in Address 07. Default = 20% or 14 (HEX)
07	This value is the HEX percentage for the switch off frequency difference from the learn frequency. This value must always be larger as the value in Address 06. Default = 30% or 1E (HEX).
08	This is the switch off counter value for both relays. That is how many counts in sequence the frequency must be out of specification before the relays switch off. 02 is the default value.
09	This is the maximum percentage that the lower of the mark or space ratio can be for a valid learning frequency. 40% is the default value. (28-HEX).