CFM750E Front End Power Supply

APPLICATION NOTE

This Note Cover:

CFM750E-240 Power Supply

CFM750E-360 Power Supply

CFM750E-480 Power Supply

Department	Approved By	Checked By	Reported By
Research and Development Department	David	Victor	Victor
Quality Assurance Department	Jack	Benny	

Change list

Revision	Date	Change Description	Signature
Preliminary	2008/09/30	Original Release	Victor

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CFM750E POWER SUPPLY SAFETY INSTRUCTIONS

IMPORTANT SAFETY INSTRUCTIONS

Operating personnel must not remove the CFM750E series power supply cover.
No internal adjustment or component replacement is allowed by non Cincon qualified service personnel. Never replace components with power cable connected. To avoid injuries, always disconnect power, discharge circuits and remove external voltage sources before touching components. These products are not authorized for use as critical components in nuclear control systems, life support systems or equipment for use in hazardous environments without the express written approval of the managing director of Cincon.
Restricted Access Area: The equipment should only be installed in a Restricted Access Area. Access should be available to service personnel only.

SAFETY APPROVALS

UL60950,UL Recognized, C-UL for Canada.IEC/EN60950. CE marking, when applied to the CFM750E, indicates compliance with the Low Voltage Directive (73/23EEC) in that it complies with EN60950.

SAFETY-CLASS OF INSULATION

The CFM750E Series Power Supply are designed for the following safety parameters: Material group IIIa, Pollution degree2, Class I (Earthed), indoor use as part of an overall equipment such that the CFM750E products is accessible to service personnel only.

GROUNDING

These products are Safety Class I instruments. To minimize shock hazard, the instruments chassis must be connected to an electrical ground. The instruments must be connected to the AC power supply mains through a three conductor power cable, with the ground wire firmly connected to an electrical ground (safety ground) at the power outlet.
For instrument designed to be hard-wired to the supply mains, the protective earth terminal must be connected to the safety electrical ground before any other connection is made.
Any interruption of the protective ground conductor or disconnection of the protective earth terminal will cause a potential shock hazard that might cause personal injury.

INPUT RATINGS

Do not use AC supply which exceeds the input voltage and frequency rating of these instruments. The input voltage and frequency rating is: 90~264Vac, 47~63Hz. The leakage current of the end use equipment should not exceed 3.5mA.

ENERGY HAZARD

The CFM750E series products are capable of providing hazardous energy. Manufacturers' final equipment must provide protection to service personnel against inadvertent contact with these models output terminals. If setting such that hazardous energy can occur then the output terminals or connections therefore must not be user accessible.

OVERCURRENT PROTECTION

A readily accessible listed branch circuit over current protective device rated 20A must be incorporated in the building wiring.

FUSE

There are no user replaceable fuses in the CFM750E series products. Internal fuse is sized for fault protection and if a fuse was opened it would indicate that service is required. Fuse replacement should be made by qualified technical personnel.
CFM750E fuse rating is: F1: F15A H 250Vac

1. Introduction of CFM750E

1.1 Introduction

CFM750E series is Front End power supplies that provide power source for telecom equipments, servers, industrial equipments or monitoring equipments.

1.2 Features

- 1U low profile, High power density.
- Universal Input: 90~264Vac.
- Built-in active PFC meets EN61000-3-2.
- High efficiency at 90% typical.
- Remote control power supply ON/OFF.
- Built-in remote sense for main output.
- Protections: short circuit / overload / over voltage / over temperature.
- +5V/1.0A Standby output power.
- Forced air cooling by built-in DC Fan with speed control function.
- Communication signals: AC_OK, DC_OK, OTPW etc..
- Active current sharing.
- I^2C interface bus digital communication.
- Meets CISPR/FCC Class B.

2. CFM750E Power Supply Installation

2.1 General

This Chapter contains instructions for initial inspection, preparation for use and repackaging for shipment.

NOTE

CFM750E power supplies series generate magnetic field which might affect the operation of other instruments. If your equipment is susceptible to magnetic fields, do not position it adjacent to the CFM750E unit.

2.2 Preparation for use

In order to be operational the power supply must be connected to an appropriate AC source. The AC source voltage should be within the power supply specification. Do not apply power before reading sections 2.6 and 2.7.

Table 2-1 below describes the basic setup procedure. Follow the instructions in Table 2-1 in the sequence given to prepare the power supply for use.

Table 2-1: Basic setup procedure

Step No.	Item	Description	Reference
1	Inspection	Initial physical inspection of the power supply	Section 2.3
2	Installation	Installing the power supply. Ensuring adequate ventilation.	Section 2.4
3	AC Source	AC source requirements	Section 2.5
4	Load connection	Wire size selection. Local/Remote sensing.	Section 2.6

2.3 Initial Inspection

Prior to shipment this power supply was inspected and found free of mechanical or electrical defects. Upon unpacking of the power supply, inspect for any damage which may have occurred in transit. The inspection should confirm that there is no exterior damage to the power supply.

Keep all packing material until the inspection has been completed. If damage is detected, file a claim with carrier immediately and notify the Cincon sales or service facility nearest you.

2.4 Location Mounting and Cooling

This power supply is fan cooled. The air intake is at the front panel and the exhaust is at the rear panel. Upon installation allow cooling air to reach the front panel ventilation inlets and allow minimum 50mm of unrestricted air space at the rear of the unit for the air exhaust.

2.5 AC Source Requirements

The CFM750E series can be operated from 90~264Vac, single phase.
Ensure that under heavy load, the AC voltage supplied to the power supply does not fall below the "low limit" specifications.

CAUTION

Connection of this power supply to an AC power source should be made by an electrician or other qualified personnel.

WARNING

There is a potential shock hazard if the power supply chassis and cover are not connected to an electrical safety ground via the safety ground in the AC input connector.

2.6 Connecting the Load

WARNING

Turn off the AC input power before making or changing any rear panel connection. Ensure that all connections are securely tightened before applying power. There is a potential shock hazard when using a power supply with a rated output greater than 40V.

2. 6.1 Load Wiring

The following considerations should be made to select wiring for connecting the load to the power supply:

- Current carrying capacity of the wire (refer to 2.6.2).
- Insulation rating of the wire should be at least equivalent to the maximum output voltage of the power supply.
- Maximum wire length and voltage drop (refer to 2.6.2).

2. 6.2 Current Carrying Capacity

Two factors must be considered while selecting the wire size.

1. Wires should be at least heavy enough not overheating while carrying the power supply load current at the rated load, or the current that would flow in the event the load wires were shorted, whichever is greater.
2. Wire size should be selected to enable voltage drop per lead to be less than 1.0V at the rated current. Please refer to Table 2-2 for maximum wire length to limit the voltage drop in American and European dimensions respectively.

Table 2-2: Maximum wire length for 0.5V drop on lead (in feet)

AWG	Resistivity OHM/Kft	Maximum length in Feet to limit voltage drop to 0.5V or less.				
		5A	10A	20A	50A	150A
14	2.526	40	20	10	4	1
12	1.589	60	30	15	6	1.7
10	0.9994	100	50	25	10	3
8	0.6285	160	80	40	16	5
6	0.3953	250	125	62.5	25	8
4	0.2486	400	200	100	40	13
2	0.1564	600	300	150	62.5	20
0	0.0983	1000	500	250	100	34

For currents not shown in Tables 2-2, use the formula:

Maximum length=1000/(current*resistivity)

Where current is expressed in amperes and resistivity in ohms/Km or ohms/1000ft.

3. Functions and Features

3.1 Input Voltage Range

Input voltage is single phase 90~264Vac (47~63Hz). Input voltage which is out of the specifications might cause damage to the unit.

3.2 +5VSB (5V Standby Output)

A 5.0V output is provided (Referenced to the signal GND).The maximum output current from this output is 1.0A. Use this output for the control and monitoring signals described in this application or to operate application circuits.

3.3 Over Voltage Protection (OVP)

The OVP triggers when the output voltage exceeds the maximum rating and reaches the OVP limit. When the OVP is triggered, the output voltage shuts down. In order to resume operation, the AC input voltage should be removed for more than 15 sec or setting ON/OFF high for more than 1s.

3.4 Over Current Protection (OCP)

A over current protection with automatic recovery is provided. The output voltage recovers automatically when the overload condition is removed. Avoid operating the power supply under overload condition for long time as it might cause damage to the power supply.

3.5 Over Temperature Protection (OTP)

The OTP is activated when the ambient temperature or the power supply internal temperature exceeds a safety temperature. When the OTP is activated, the power supply output shuts down. The output recovers automatically when the ambient temperature or the internal temperature cools to a safe limit.

3.6 OTPW signal (Over Temperature Alarm)

An open collect output provides an Over Temperature Alarm before shut down by the OTP. The output is referenced to signal GND potential.

The maximum source/sink current is 10mA and maximum external voltage is 15V.

Refer to Fig3.1 for typical application.

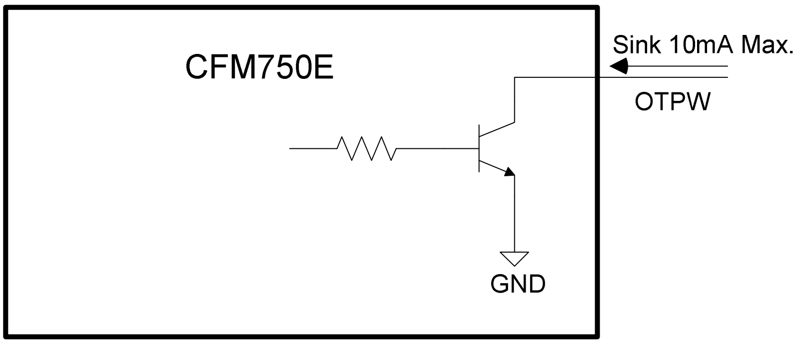

Fig 3.1: OTPW Signal Application

3.7 DC_OK Signal (Power Good)

An open collector output provides a low output voltage detection signal. The open collector output is on when the output voltage is higher than 80% typ. of the rated output voltage of the power supply.

The open collector output is referenced to the signal GND potential.

The maximum sink current is 10mA and the maximum external voltage is 15V.

The internal connection and typical application is same as OTPW signal, refer to Fig3.1 for the typical connection application.

3.8 AC_OK Signal

An open collector output provides a low AC input voltage detection signal. The open collector output is on when the input voltage is 85Vac typ. or higher.

The open collector output is referenced to the signal GND potential.

The maximum sink current is 10mA and the maximum external voltage is 15V.

The internal connection and typical application is same as OTPW signal; refer to Fig3.1 for typical connection application.

3.9 ON/OFF (Remote ON/OFF Control)

A remote ON/OFF control input is provided. The remote ON/OFF input is referenced to the signals GND potential. The remote ON/OFF can be operated either by electrical signal or by dry contact.

(1) Operation by electrical signal:

0~0.6V: Output is ON.

2~5V: Output is OFF.

The maximum sink current is 2.6mA and the maximum external voltage is 5V.

(2) Operation by dry contact (relay or switch)

Short between ON/OFF input and signals GND: Output is ON.

Open circuit between ON/OFF input and signals GND: Output is OFF.

When the Remote ON/OFF function is not used, connect a short circuit between the ON/OFF control and the signal GND. Fig3.2 shows the typical application circuits.

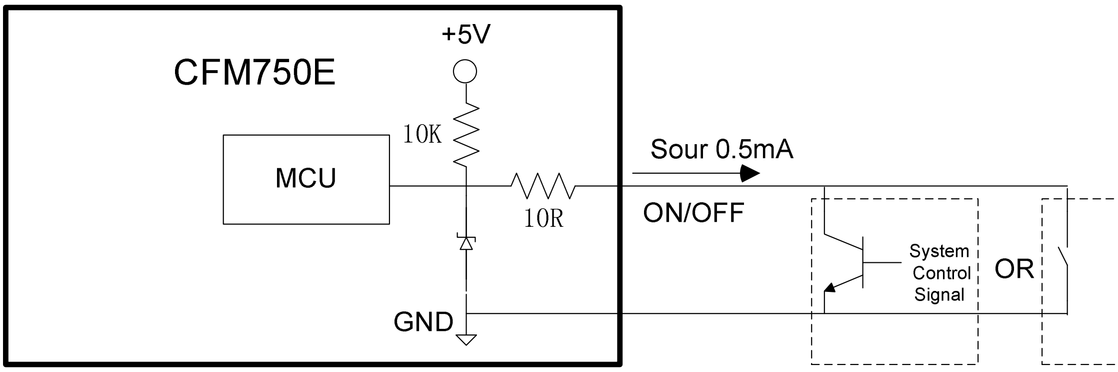

Fig3.2: ON/OFF Control Application

3.10 +SENSE, -SENSE (Remote Sensing) , show S+, S- on the drawing below

The remote sensing compensates voltage drop on the load wiring. The maximum voltage drop on each wire is 0.5V, however, it is recommended to minimize the voltage drop on the load wires to improve the response to load current changes.

In case that the sensing wires are long, use separate twisted pair wires for the sensing and for the load wires to minimize noise pick-up.

It is recommended to connect electrolytic capacitors in the following locations:

(1) Across the load terminals

(2) Between the "+SENSE" terminal and the "V+"terminal of the power supply.

(3) Between the "-SENSE" terminal and the "V-"terminal of the power supply.

Refer to Fig 4-2 for typical connection of remote sensing.

3.11 V_TRIM (Output Voltage Trimming)

The output voltage can be adjusted within the specifications via the V_TRIM pin at the Output connector.

Refer to Fig3.2 typical connection. When trimming up output voltage, connect one resistor (R2) to signal ground and left R1 open. When trimming down output voltage, left R2 open and connect one resistor (R1) to 5V standby output. Formula (1), (2) give the select methods.

Note that the Over Voltage Protection may trigger if the output voltage exceeds the maximum voltage specification.

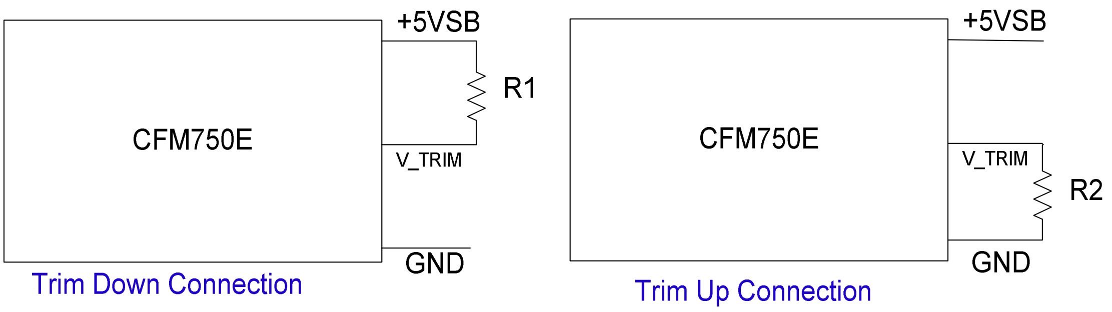

Fig 3.2: Typical Trim Connection

Trim Down:

$$Vo := \left(1 - \frac{1.25}{1 + R1}\right) \cdot Vonom$$ ……………………………………………….(1)

R1: Trim Down Resistor (K.Ohm)

Vonom: Nominal Output Voltage (Vdc)

Trim Up:

$$Vo := \left(1 + \frac{1.25}{1 + R2}\right) \cdot Vonom$$ ……………………………………………….(2)

R2: Trim Up Resistor (K.Ohm)

Vonom: Nominal Output Voltage (Vdc)

3.12 I_SHARE (Active Current Share Control)

The load share signal (I_SHARE) provides both output current information and the load sharing function. The characteristics of the load share signal are defined below in Table 3.1. Details about parallel application see section 5.

Table 3.1: Load Share Bus Output Characteristic

Item	Description	NOM	Units
I_SHARE @ $I_{out}=I_{max}$	Voltage of load share bus at specified max output current.	5	V
V_{share}/I_{out} @ I_{out}>1 A	Slope of load share bus voltage with changing load.	5 / I_{max}	V/A

4. Basic Connections for Operation

4.1 Connecting Signal Load, Local Sensing

Local sensing is suitable for applications where load regulation is not critical. Fig 4.1 shows recommended load and sensing connections for applications with a single load.

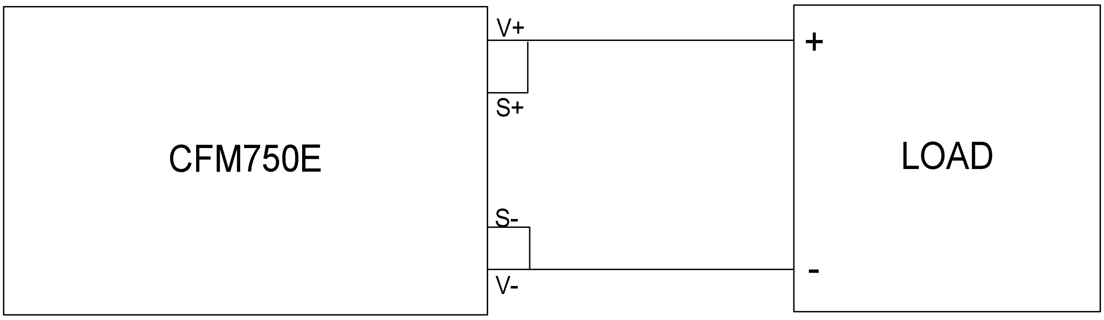

Fig 4.1: Single Load Connection, Local Sensing

4.2 Connecting Single Load, Remote Sensing

Remote sensing is used in cases where the load regulation is important at the load terminals. Use twisted or shielded wires to minimize noise pick-up. If shielded wires are used the shield should be connected to the ground at one point, either the power supply side or the load. The optimal point for the shield ground should be determined by experimentation. Refer to the power supply specifications for the maximum voltage drop allowed at the load wires.

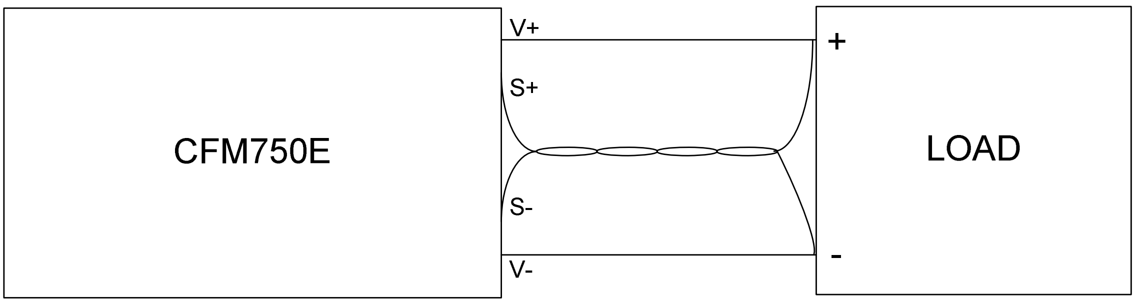

Fig 4.2: Remote Sensing, Single Load

4.3 Connecting Multiple Loads, Radial Distribution Method

In cases of multiple loads connected to one supply, each load should be connected to the power supply's output terminals using separate pairs of wires. It is recommended that each pair of wires will be as short as possible and twisted or shielded to minimize noise pick-up and radiation.

The sense wires should be connected to the power supply output terminals or to the load with the most critical load regulation requirement.

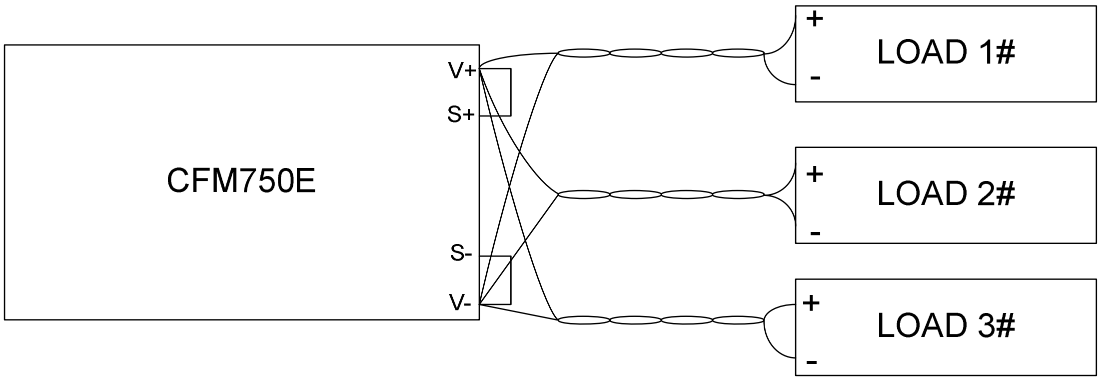

Fig 4.3: Multiple Loads Connection, Radial Distribution

4.4 Multiple Loads Connection with Distribution Terminals

If remotely located output distribution terminals are used, the power supply output terminals should be connected to the distribution terminals by a pair of twisted or shielded wires. Each load should be separately connected to the remote distribution terminals (see Fig 4-4). If remote sensing is required, the sensing wires should be connected to the distribution terminals or at the most critical load.

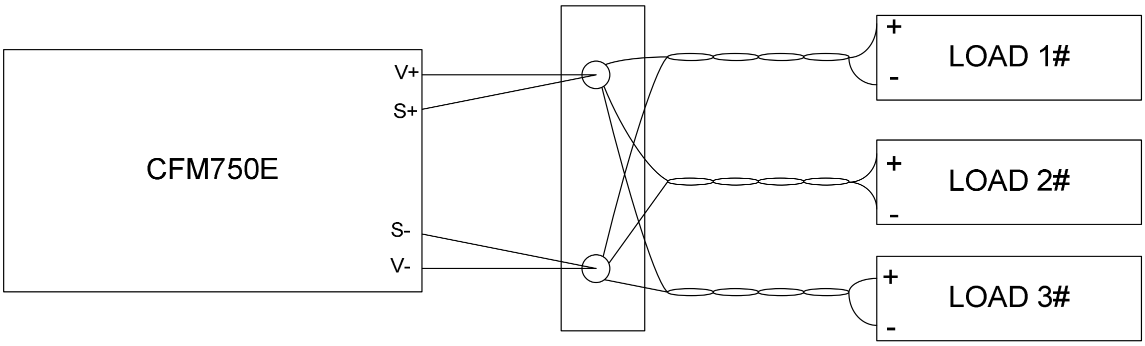

Fig 4.4: Multiple Loads Connection with Distribution Terminal

5. Parallel and Series Operation

5.1 Parallel operation

By connecting the I_SHARE signal between the paralleled units, automatic current balance is achieved. Derated the total output current by 10% typ. when using parallel operation to prevent overload condition.

5.1.1 Parallel operation with Remote Sensing

Fig 5.1 shows typical connection of parallel operation with remote sensing. The I_SHARE signal wires should be as short as possible and with the same length.

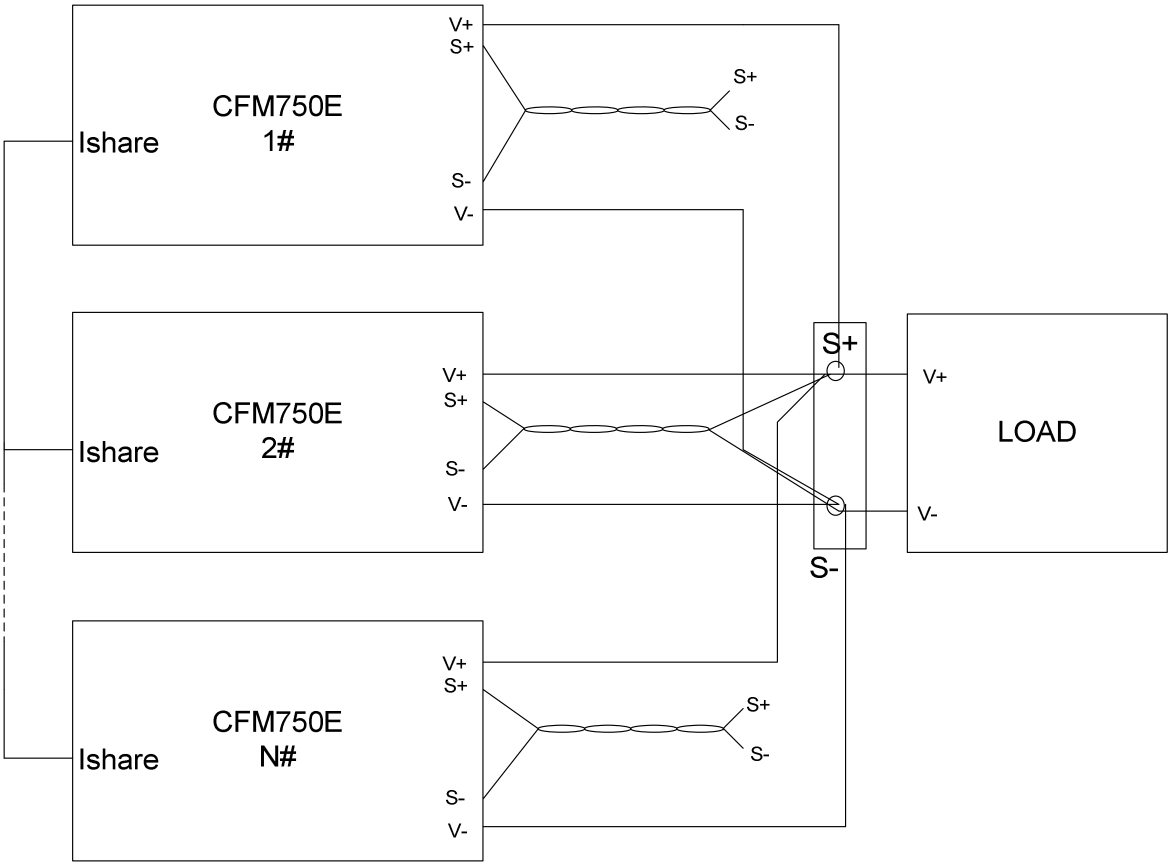

Fig 5.1: Parallel Operation with Remote Sensing

5.1.2 Output Voltage Trimming at Parallel Operation

The output voltage of the units connected in parallel can be made by a single trimmer same as single units. Connecting all trim pin together and set the trim resistor as singe one trimming.

5.1.3 Signal GND Bus at Parallel Operation

The signal return (signal GND) of each paralleled unit can be connected together to form a common signal GND bus. By this way, the control and monitoring signals of the paralleled units can be connected to the same control and monitoring circuitry. The signal GND bus can be connected to V- or -SENSE or float.

5.1.4 Remote ON/OFF Control at Parallel Operation

The paralleled units can be turned on or off via a single on/off control. Refer to Fig 5-2 for typical application. The signal return function of all the paralleled units should be connected together to create a common signal GND bus. The signal GND bus may be connected to the V- or -SENSE or floated. In any case do not connect the signal GND bus to different potentials.

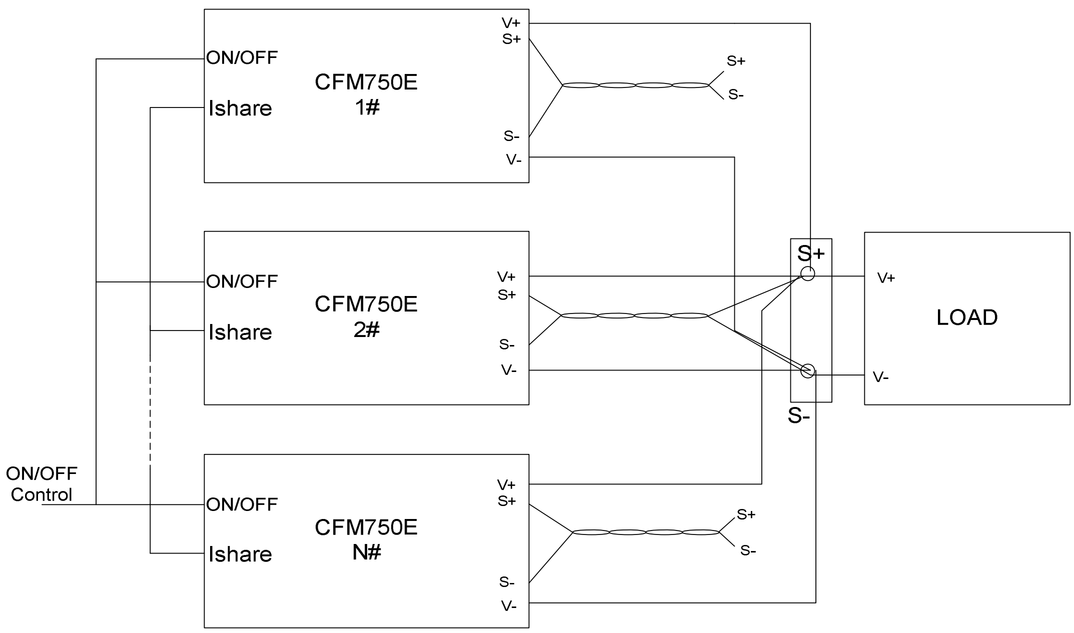

Fig 5-2: Parallel operation ON/OFF control

5.2 Series Operation

Two units can be serially connected to increase the output voltage or to create a bipolar voltage source. It is recommended to connect diodes in parallel with each output to prevent reverse voltage in case of failure in one of the power supplies. Each diode should be rated to at least the power supply rated output voltage and output current.

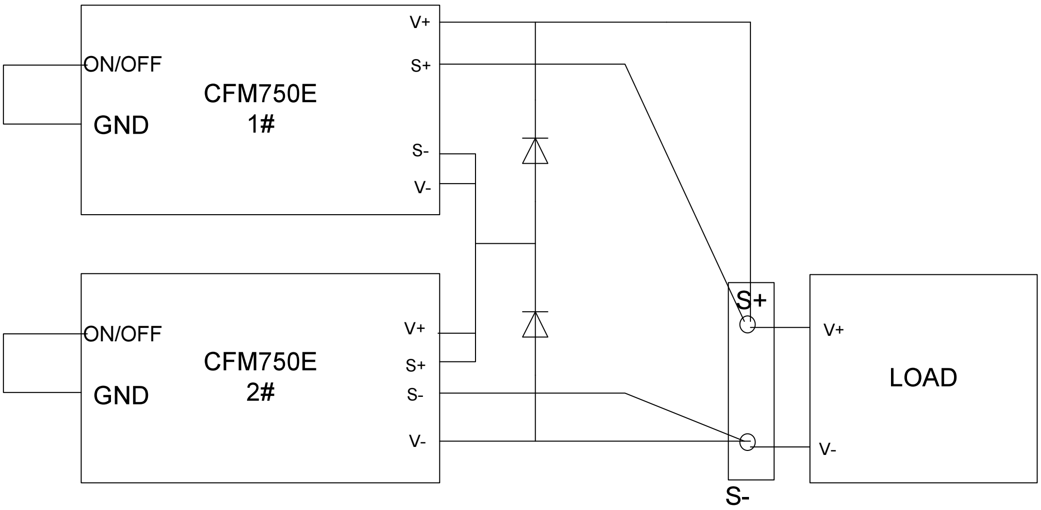

Fig 5.3-1: Series connection for increased output voltage

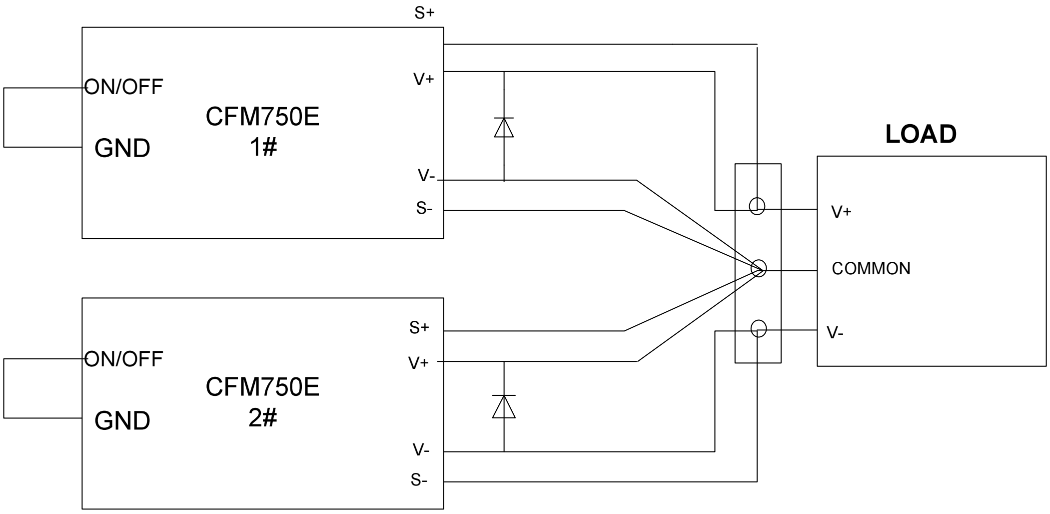

Fig 5.3-2: Series connection for positive and negative output voltage

CAUTION

Series operation is not applicable for I^{2}C bus function..

Don’t series or parallel standby output when series main output application.

Don’t connect the signal GND together when series application.

6. I²C BUS INTERFACE

6.1 Introduction

The I²C interface option includes facilities to monitor operating parameters of the power supply. The parameters are then transferred to the host PC if demanded, over as standard I²C bus.

The following data can be monitored for the individual units connected to the I²C bus:

1. Status of the unit.
2. Output voltage, output current and internal temperature of the unit.
3. Manufacturing related data (Manufacture Name, Model name, Revision).

6.1.1 Addressing (I²C-A0, I²C -A1)

CFM750E series have two address port I²C A0, I²C A1 so user can addressing up to four units. Connect address port to signal GND represents address "0".

6.1.2 Serial Clock (I²C-SCL)

This line is clocked by the processor which controls the I²C bus. It should be connected to +5V (referenced to signal GND) via a pull-up resistor of 2K OHM. The I²C interface is designed to run with a serial clock speed of 100KHz.

6.1.3 Serial Data (I²C-SDA)

This line is a bidirectional data line. It should be connected to +5V (reference to signal GND) via a pull-up resistor of 2K OHM.

6.2 I²C Digital Control

6.2.1 I²C ON/OFF Control (BYTE1)

Write one byte to MCU internal BYTE1 via I²C communication bus, can control the output ON or OFF, when the data on the BYTE2 of MCU is Nonzero.

Write Nonzero to first byte (BYTE1) of MCU = Output OFF
Write"0" to first byte of MCU = Output ON

6.2.2 Control Method Selection (BYTE2)

The user can set the power module ON/OFF controlled by ON/OFF signal or by I²C communication. The default setting is by ON/OFF signal control. When user's wanted to set the unit ON/OFF control by I²C communication, just write one

Nonzero byte to MCU internal BYTE2 via I^2C communication bus.

Write Nonzero to second byte (BYTE2) of MCU = by I^2C Control;
Write "0" to second byte (BYTE2) of MCU = by ON/OFF signal Control.

6.3 I^2C Digital Data

6.3.1 Output Voltage measurement (BYTE1)

1. Measurement resolution: 8 bits
2. Measurement range: 0~60.0V

Output voltage value (V) =
6.9 * Z for 24V model
14.3 * Z for 36V model
13.7 * Z for 48V model
Z = N / 51.2; N is the Decimal value of readout byte (HEX)

6.3.2 Output Current Measurement (BYTE2)

1. Measurement resolution: 8 bits
2. Measurement range: 0~35A

Output current value (A) =
Z / 0.07 for 24V model
Z / 0.1 for 36V model
Z / 0.16 for 48V model
Z= N / 51.2; N is the Decimal value of readout byte (HEX)

6.3.3 +5VSB output Voltage (BYTE3)

1. Measurement resolution: 8 bits
2. Measurement range: 0~6.0V

Output voltage value (V) = 2 * Z for all models
Z= N / 51.2; N is the Decimal value of readout byte (HEX)

6.3.4 Fan Speed Measurement (BYTE4)

1. Measurement resolution: 8 bits
2. Measurement range: 0~10000RPM

Fan speed (RPM) =50N-2400
N is the Decimal value of readout byte (HEX)

6.3.5 Internal Temperature Measurement (BYTE5)

1. Measurement resolution: 8 bits
2. Measurement range: 0~100C

Temperature (℃) =3435/｛ln [(13056-51N)/784N-8704]+11.25｝-273.15

N is the Decimal value of readout byte (HEX)

6.3.6 Status Register (BYTE6)

Register content:

Bit0 : AC input OK , “1”= good; ”0”= fail

Bit1 : Main output DC OK , “1”= good; ”0”= fail

Bit2 : Local On/Off control status,

“1”=Local ON/OFF signal is ON

”0”=Local ON/OFF signal is OFF

Bit3 : Over temperature warning,

“1”=under over temperature about 10℃

”0”=OK

Bit4 : Fan fail warning , “1”= Fan fail; ”0”=OK

Bit5 : Main output over voltage , “1”= Over voltage; ”0”=OK

Bit6 : Main output over current , “1”= Over current; ”0”=OK

Bit7 : Over temperature protection , “1”= Over temperature; ”0”=OK

“1”=The temperature is over

”0”=OK

6.3.7 EEPROM

1. EEPROM type: MCU internal
2. EEPROM data:

Byte7 (ASCII) ~ Byte12 (ASCII): 6 bytes Company name “CINCON”

Byte13 (ASCII) ~ Byte23 (ASCII): 11 bytes model name ex. “CFM750E-240”

Byte24 (ASCII) ~ Byte26 (ASCII): 3 bytes revision number ex. “V10”