



OPAL-RT FIU

User Guide







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SYMBOL DEFINITIONS

The following table lists the symbols used in this document to denote certain conditions:

Symbol	Definition
	ATTENTION: Identifies information that requires special consideration
	TIP: Identifies advice or hints for the user, often in terms of performing a task
	REFERENCE _ INTERNAL: Identifies an additional source of information within the bookset.
CAUTION	Indicates a situation which, if not avoided, may result in equipment or work (data) on the system being damaged or lost, or may result in the inability to properly operate the process.
	Indicates a situation where users must observe precautions for handling electrostatic sensitive devices.
	CAUTION: Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury. It may also be used to alert against unsafe practices.
	WARNING: Indicates a potentially hazardous situation which, if not avoided, could result in serious injury or death.

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INTRODUCTION

The OP8630 is a Fault Insertion Unit (FIU) device that includes both hardware and software (model) components. It is designed to float, short to power, short to ground, add impedance or close the circuit between one or several conductors of a vehicle control module connected to a simulator. In the actual vehicle there are up to 120 independently programmable channels that may be used during a test sequence. All circuits modified during a test sequence are changed using relay contacts.

OPERATION

Refer to fig.1. This schematic illustrates four typical channels contained within the FIU. For normal operation of the module under test, all relays are left in the non-energized position. This provides up to 120 separate paths for I/O lines.

The shorting bus: I/O signals may be short circuited with each other, ext. +12V or GND. for the duration of a test cycle. This is accomplished by closing the respective bus relay contacts with an isolated shorting bus. When all the relays in the FIU are in the non-energized position the shorting bus is floating. (connected to nothing).

Shorting bus floating: This floating bus is used to connect several module I/O lines together.

Shorting to ground: This shorting bus can be tied to ext. GND. to allow simulating a short circuit condition between module I/O Line and the vehicle ground. This is accomplished by energizing the “Float” relay and the respective module I/O lines.

Shorting to power: The bus can be used to connect module I/O line to the positive ext. 12V connection when both the “Bus +12/gnd” and “float” relays are energized as well as the respective module I/O lines.

Adding impedances: A 1K and 10K ten turn potentiometer have been included on the front panel of the FIU. These potentiometers may be used to add resistance between module I/O lines or between I/O lines and GND or +12V. A fuse has been added to the wiper of each potentiometer to prevent an accidental over-current condition. Patch cords are to be used to connect between the pre-fault and/or the post-fault mini-jacks and the potentiometer mini-jack.

POWER REQUIREMENTS

Each FIU must be powered directly from the 110VAC line and Ext.24VDC to power the shorting bus. Overload protection is included in the software, which limits the maximum number of relays activated during a single test cycle.

OPERATING IN STANDALONE MODE

Each FIU unit includes an AC power cord. This must be connected to any 115VAC standard grounded outlet. This primary AC circuitry is protected by F1 a 3AG 5A fuse. While operating from the AC line, pin one of the “EXT 12V IN” connector floats. AC power is applied to the internal power supply when the “AC Power” switch is moved to the “ON” position.

OPERATING SHORTING BUS FROM EXTERNAL POWER

Each FIU unit includes a vehicle DC power cord terminated with a cigarette lighter adapter plug. Polarity protection is included in the circuitry to prevent accidental +12V and GND reversal. If the power is reversed, an internal diode will not forward bias to allow pulling in the external power relay. Because of the high current available while operating from vehicle power, care must be taken to prevent conditions in the circuitry under test that exceed the 10 ampere maximum rating of the pins in the two 120 pin connectors.

SAFETY OVERLOAD PROTECTION

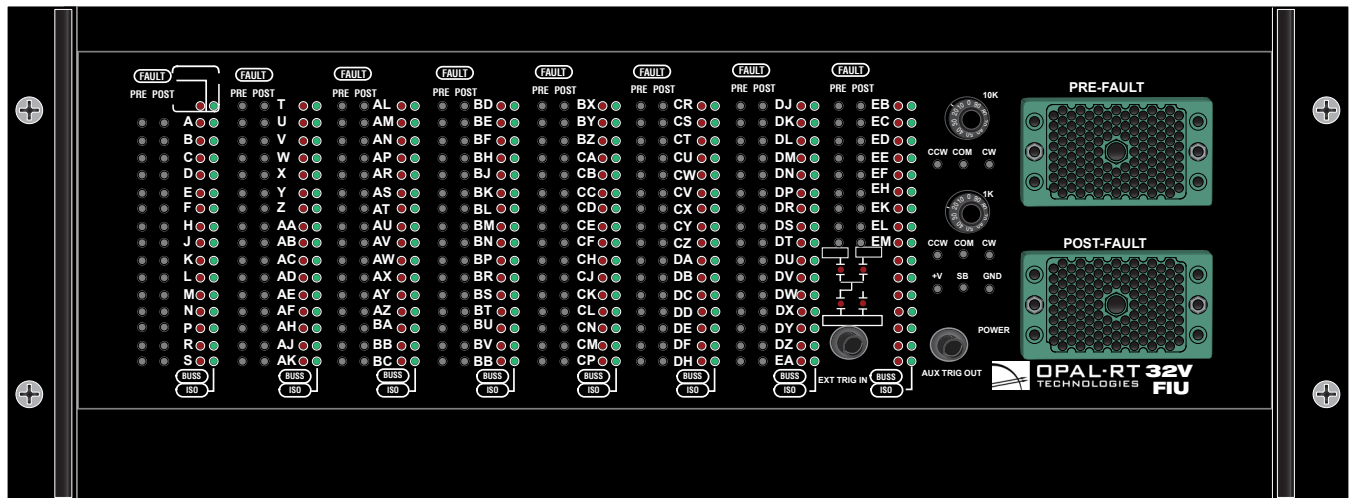
Fuses have been included in the circuitry as follows:

- F1 AC LINE FUSE 3AG 5A
- F2 12VDC SHORTING BUS POWER 3A G 20A
- F3 12VDC RELAY POWER 3AG 5A
- F4 1K POTENTIOMETER CURRENT LIMIT PICO 1/8A F5 10K POTENTIOMETER CURRENT LIMIT PICO 1/8A



Note: F4 and F5 (and two spare PICO fuses) are located under the top cover of the FIU unit.

CONNECTORS AND LEDs



The FIU interface is comprised of a series of monitoring connectors and LEDs, Pre and POST fault ELCO connectors and potentiometers.

Cables from the OPAL-RT simulator are connected to the PRE-FAULT ELCO connectors and the POST-FAULT ELCO connectors are output to the unit under test.

The columns of identically labeled connectors, with their status LEDs, allow users to monitor the faults.

SCHEMATICS AND DIAGRAMS

FOUR TYPICAL CIRCUITS WITH SHORTING BUS

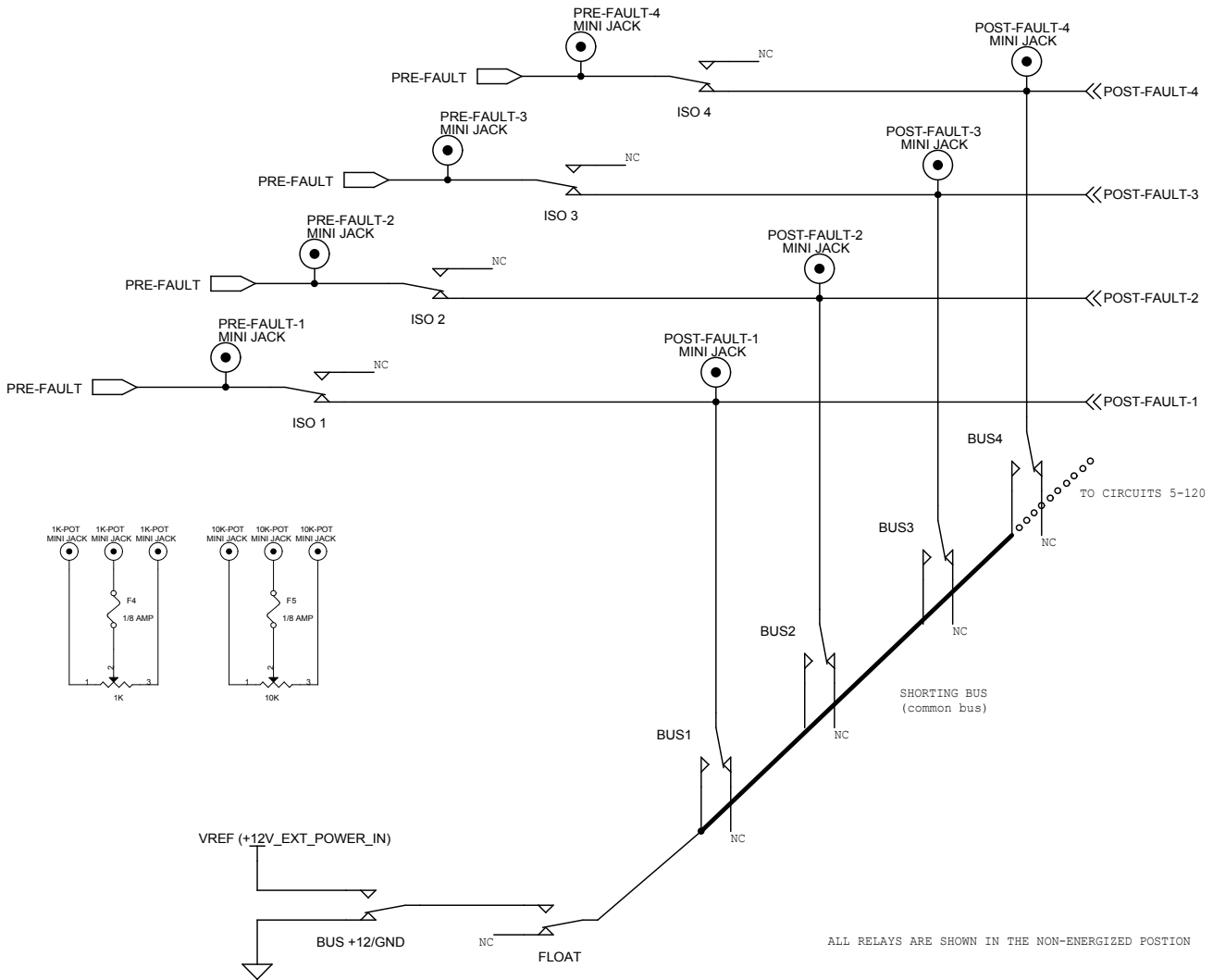


Figure 1: Four typical circuits diagram

The following diagrams represent one channel (extrated from “Figure 1: Four typical circuits diagram”) in various states:

Normal State

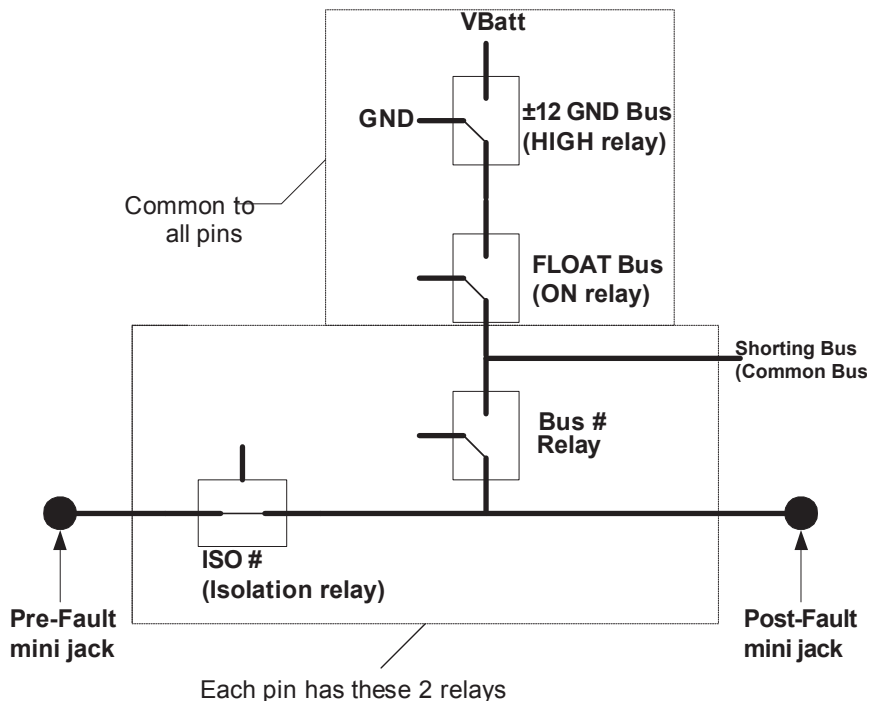


Figure 2: Normal relay state diagram

Open State

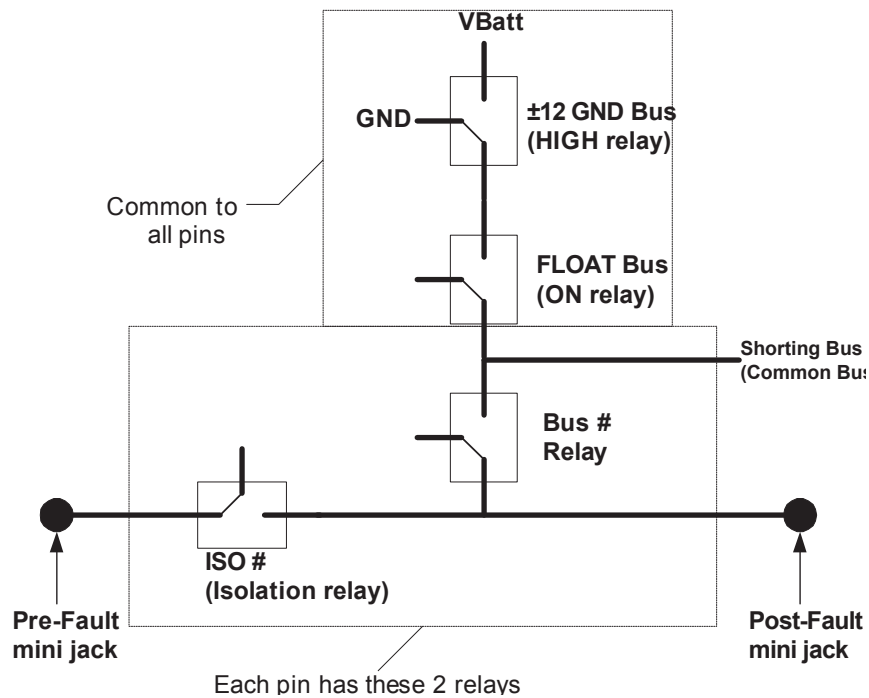


Figure 3: Open relay state diagram

Isolated GND State

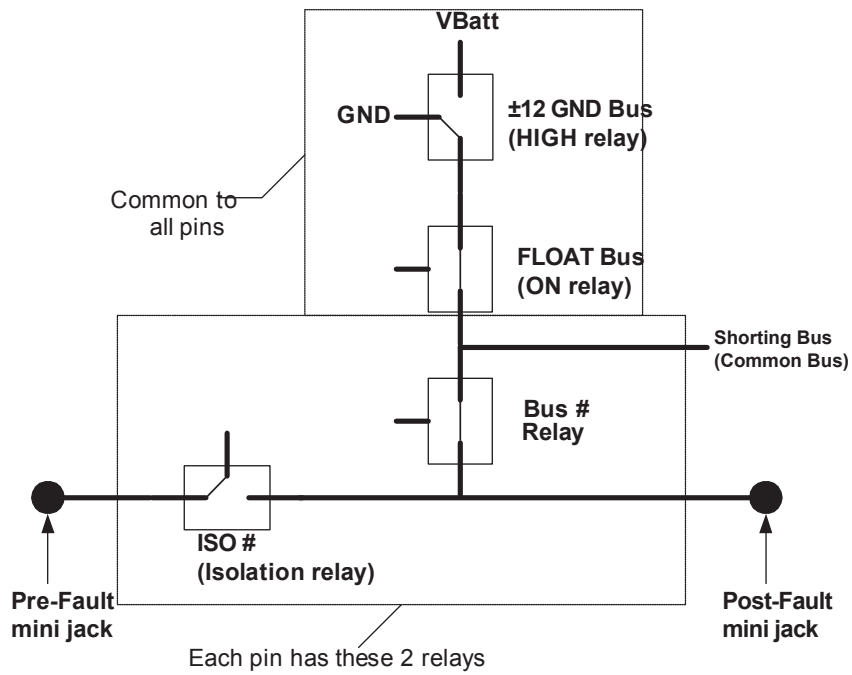


Figure 4: Isolated GND state diagram

Isolated VBatt State

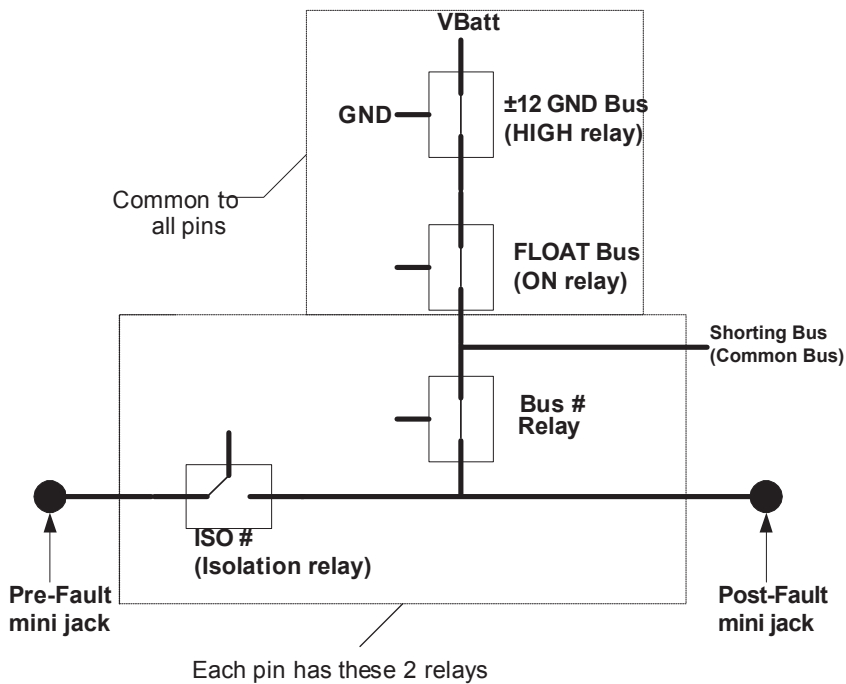


Figure 5: Isolated VBatt state diagram

Isolated BUS State

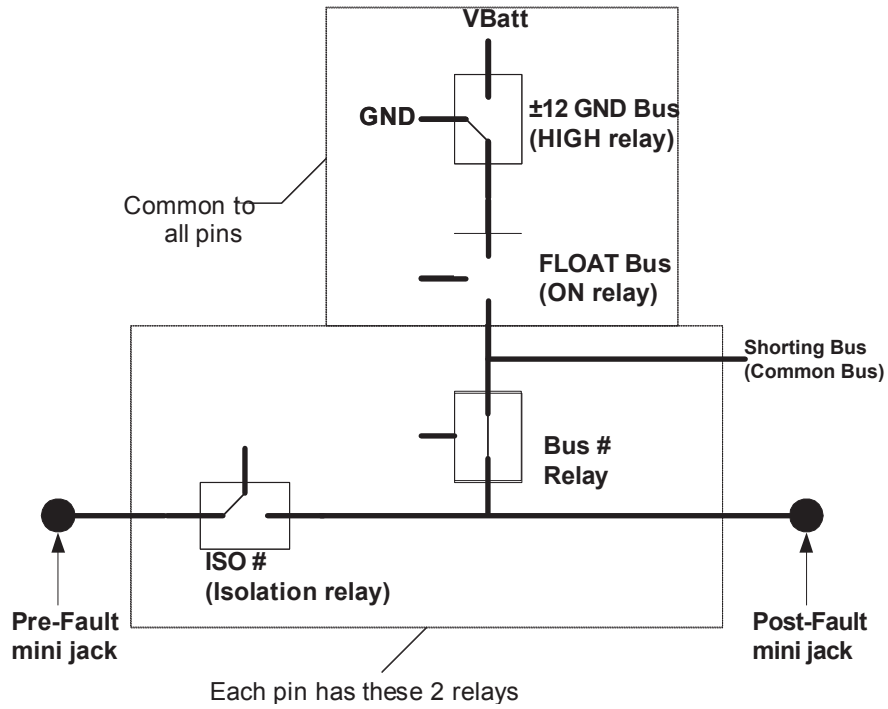


Figure 6: Isolated BUS state diagram

Non-Isolated BUS State

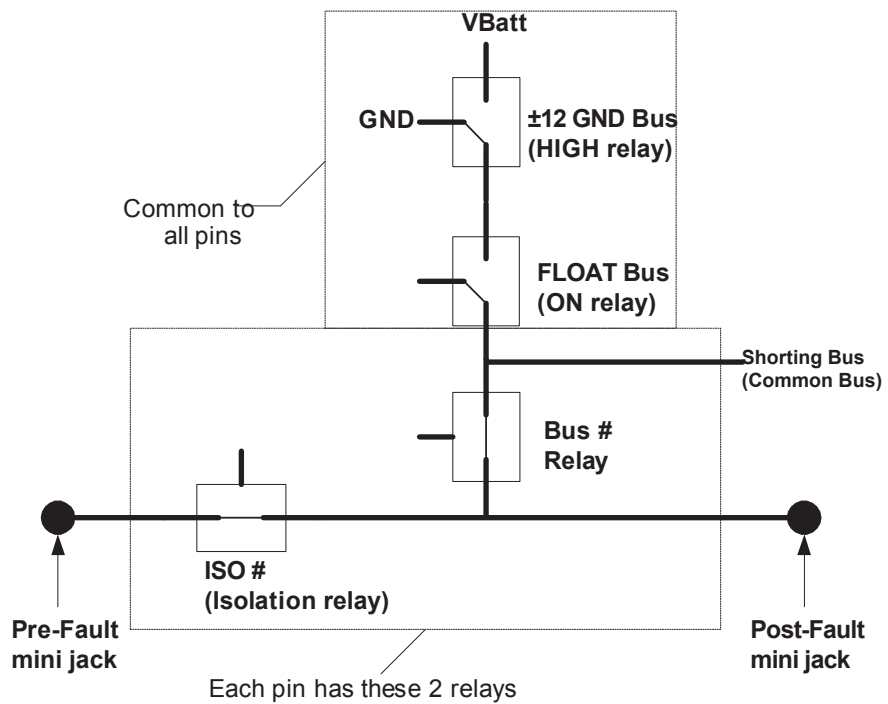


Figure 7: Non-isolated BUS state diagram

Non-Isolated GND State

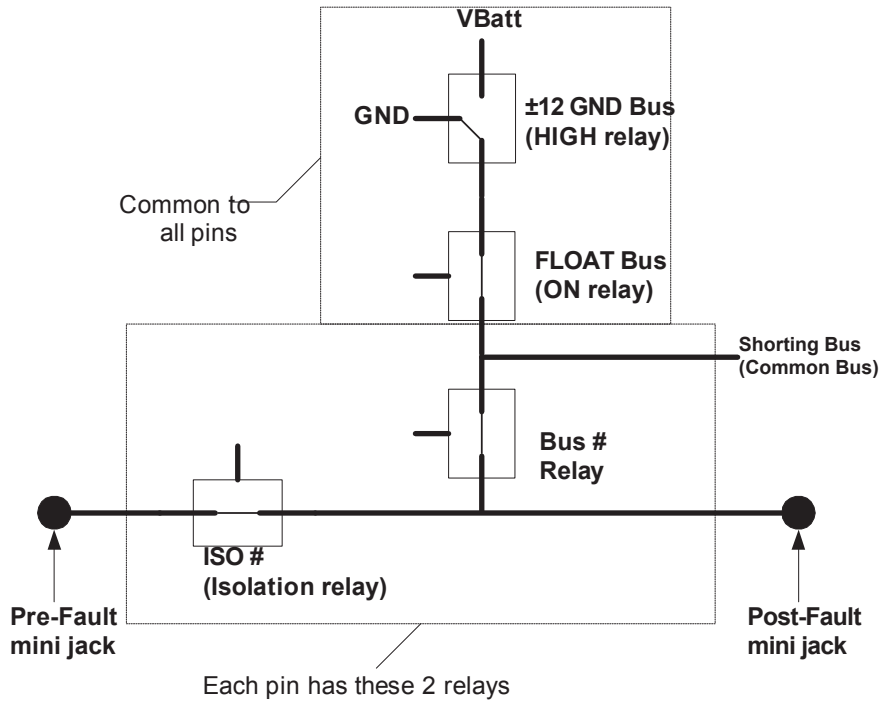


Figure 8: Non-isolated GND state diagram

Non-Isolated VBatt State

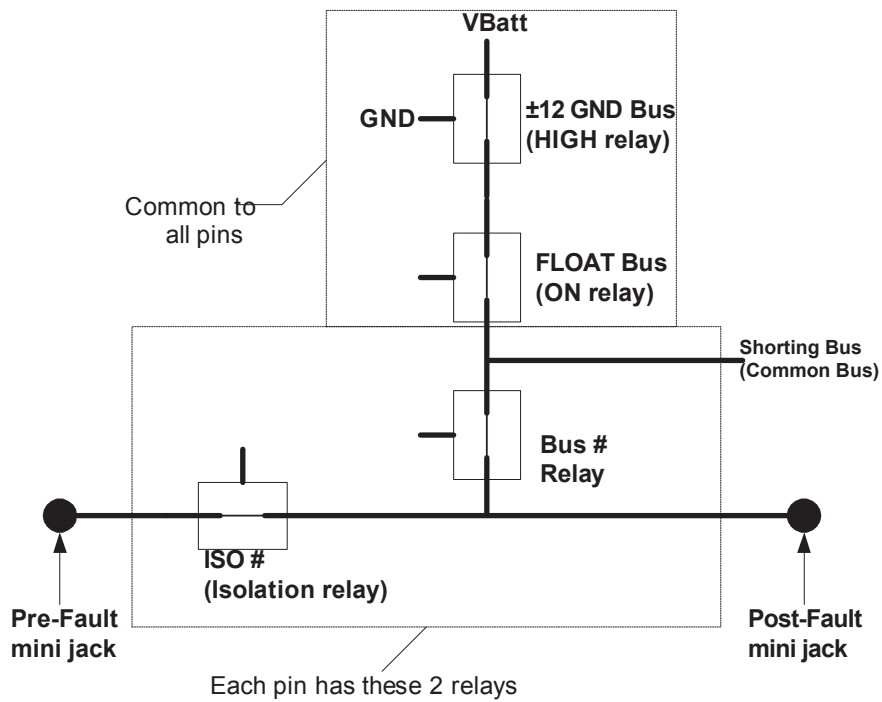
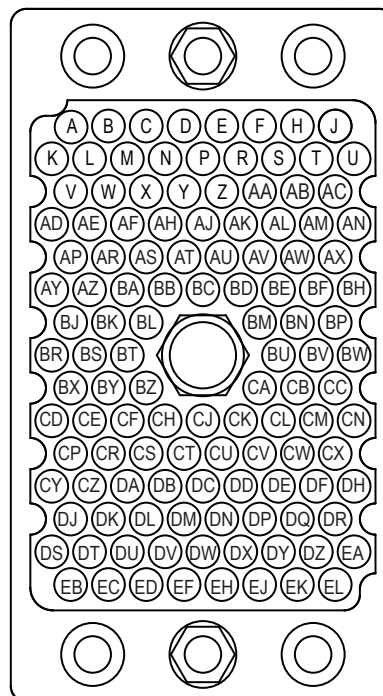


Figure 9: Non-isolated VBatt state diagram

PIN ASSIGNMENTS

The following table lists the signals available on the system's two ELCO connectors. The rows of monitoring connectors on the front of the unit are labelled exactly the same as the ELCO connectors

FIU Monitoring PRE FAULT	FIU Monitoring POST FAULT	PRE-FAULT ELCO Pin	POST-FAULT ELCO Pin
A	A	A	A
B	B	B	B
C	C	C	C
D	D	D	D
E	E	E	E
F	F	F	F
H	H	H	H
J	J	J	J
K	K	K	K
L	L	L	L
M	M	M	M
N	N	N	N
P	P	P	P
R	R	R	R
S	S	S	S
T	T	T	T
U	U	U	U
V	V	V	V
W	W	W	W
X	X	X	X
Y	Y	Y	Y
Z	Z	Z	Z
AA	AA	AA	AA
AB	AB	AB	AB
AC	AC	AC	AC
AD	AD	AD	AD
AE	AE	AE	AE
AF	AF	AF	AF
AH	AH	AH	AH
AJ	AJ	AJ	AJ
AK	AK	AK	AK
AL	AL	AL	AL
AM	AM	AM	AM
AN	AN	AN	AN
AP	AP	AP	AP
AR	AR	AR	AR
AS	AS	AS	AS
AT	AT	AT	AT
AU	AU	AU	AU
AV	AV	AV	AV
AW	AW	AW	AW
AX	AX	AX	AX
AY	AY	AY	AY
AZ	AZ	AZ	AZ
BA	BA	BA	BA
BB	BB	BB	BB
BC	BC	BC	BC
BD	BD	BD	BD
BE	BE	BE	BE
BF	BF	BF	BF



Pin Assignments

FIU Monitoring PRE FAULT	FIU Monitoring POST FAULT	PRE-FAULT ELCO Pin	POST-FAULT ELCO Pin
BH	BH	BH	BH
BJ	BJ	BJ	BJ
BK	BK	BK	BK
BL	BL	BL	BL
BM	BM	BM	BM
BN	BN	BN	BN
BP	BP	BP	BP
BR	BR	BR	BR
BS	BS	BS	BS
BT	BT	BT	BT
BU	BU	BU	BU
BV	BV	BV	BV
BW	BW	BW	BW
BX	BX	BX	BX
BY	BY	BY	BY
BZ	BZ	BZ	BZ
CA	CA	CA	CA
CB	CB	CB	CB
CC	CC	CC	CC
CD	CD	CD	CD
CE	CE	CE	CE
CF	CF	CF	CF
CH	CH	CH	CH
CJ	CJ	CJ	CJ
CK	CK	CK	CK
CL	CL	CL	CL
CM	CM	CM	CM
CN	CN	CN	CN
CP	CP	CP	CP
CR	CR	CR	CR
CS	CS	CS	CS
CT	CT	CT	CT
CU	CU	CU	CU
CV	CV	CV	CV
CW	CW	CW	CW
CX	CX	CX	CX
CY	CY	CY	CY
CZ	CZ	CZ	CZ
DA	DA	DA	DA
DB	DB	DB	DB
DC	DC	DC	DC
DD	DD	DD	DD
DE	DE	DE	DE
DF	DF	DF	DF
DH	DH	DH	DH
DJ	DJ	DJ	DJ
DK	DK	DK	DK
DL	DL	DL	DL
DM	DM	DM	DM
DN	DN	DN	DN
DP	DP	DP	DP
DR	DR	DR	DR
DS	DS	DS	DS
DT	DT	DT	DT
DU	DU	DU	DU
DV	DV	DV	DV

FIU Monitoring PRE FAULT	FIU Monitoring POST FAULT	PRE-FAULT ELCO Pin	POST-FAULT ELCO Pin
DW	DW	DW	DW
DY	DY	DY	DY
DZ	DZ	DZ	DZ
EA	EA	EA	EA
EB	EB	EB	EB
EC	EC	EC	EC
ED	ED	ED	ED
EE	EE	EE	EE
EF	EF	EF	EF
EH	EH	EH	EH
EJ	EJ	EJ	EJ
EK	EK	EK	EK
EL	EL	EL	EL

LIMITED WARRANTY

LIMITED WARRANTY

Opal-RT Technologies Inc. warrants to the original purchaser and/or ultimate customer (“Purchaser”) of Opal-RT products (“Product”) that if any part thereof proves to be defective in material or workmanship within one (1) year, such defective part will be repaired or replaced, free of charge, at Opal-RT Technologies’ discretion, if shipped prepaid to Opal-RT Technologies Inc. at 1751 Richardson, suite 2525, Montreal, Quebec, Canada, H3K 3G6, in a package equal to or in the original container. The Product will be returned freight prepaid and repaired or replaced if it is determined by Opal-RT Technologies Inc. that the part failed due to defective materials or workmanship. Otherwise, the fees will be charged to the client (see article “warranty limitation and exclusion”). The repair or replacement of any such defective part shall be Opal-RT Technologies’ sole and exclusive responsibility and liability under this limited warranty.

Purchaser must request an RMA number before shipping any Product for repair:

1. Access the Opal-RT website (www.opal-rt.com/support/return-merchandise-authorization-rma-request), click on support and select Return Merchandise (RMA).
2. Fill out the online form and submit. You will receive a notification with a thread-ID that will be used for further exchange with support.
3. Opal-RT’s Support department will evaluate the return and either issue an RMA number via email using the same thread-ID.
 - If the Product is returned for repair more than 12 months after purchase, the Purchaser is responsible for the cost of repair. Opal-RT will assess the repair and prepare a quote. The RMA number will be sent with the quote.
4. Only when the Purchaser receives the RMA number, may they ship the Product, prepaid, to Opal-RT.

RETURN POLICY

The following fees will apply when customers return products for credit:

A full credit, less a 15% fee and less return fee will only be issued if the product is in perfect working condition and if the product is returned within 1 month following the shipping date. If repairs are required on the returned product, the cost of these repairs will be deducted from the credit to be issued.

No credits will be issued beyond the one month period.

EXCLUSIONS

If third party products are part of the Product, Opal-RT will honor the original manufacturer’s warranty.

This limited warranty does not cover consumable items, such as batteries, or items subject to wear or periodic replacement, including lamps, fuses or filter elements.

WARRANTY LIMITATION AND EXCLUSION

opal-RT Technologies will have no further obligation under this limited warranty. All warranty obligations of Opal-RT Technologies are void if the Product has been subject to abuse, misuse, negligence, or accident or if the Purchaser fails to perform any of the duties set forth in this limited warranty or if the Product has not been operated in accordance with instructions, or if the Product serial number has been removed or altered.

DISCLAIMER OF UNSTATED WARRANTIES

the warranty printed above is the only warranty applicable to this purchase. All other warranties, express or implied, including, but not limited to, the implied warranties of merchantability or fitness for a particular purpose are hereby disclaimed.

LIMITATION OF LIABILITY

it is understood and agreed that Opal-RT Technologies' liability, whether in contract, in tort, under any warranty, in negligence or otherwise shall not exceed the amount of the purchase price paid by the purchaser for the product and under no circumstances shall Opal-RT Technologies be liable for special, indirect, or consequential damages. The price stated for the product is a consideration limiting Opal-RT Technologies' liability. No action, regardless of form, arising out of the transactions under this warranty may be brought by the purchaser more than one year after the cause of actions has occurred.

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