D2U5T-380-CONC

ACAN-62 Interface Connector Card Application Note

PRODUCT OVERVIEW (DOCUMENT REFERENCE: MRD-012-1904-1)

The D2U5T-380-CONC interface Connector Card is intended to be used to interconnect the incoming AC Source and output voltages and signals of the D2U5T-H3-5000-380-HU3C three phase rectifier power modules for laboratory/bench level evaluation of the product.

SAFETY WARNING

IT IS THE RESPONSIBILITY OF THE END USER OF THE D2U5T-380-CONC INTERFACE CONNECTOR CARD AND THE ASSOCIATED D2U5T-H3-5000-380-HU3C THREE PHASE RECTIFIER POWER MODULE TO OBSERVE LOCAL AND NATIONAL SAFETY PRACTICES WHEN DEPLOYING THESE PRODUCTS.

The D2U5T-380-CONC output connector card when interfaced with the incoming three phase AC source and the D2U5T-H3-5000-380-HU3C rectifier contains hazardous voltages as follows:

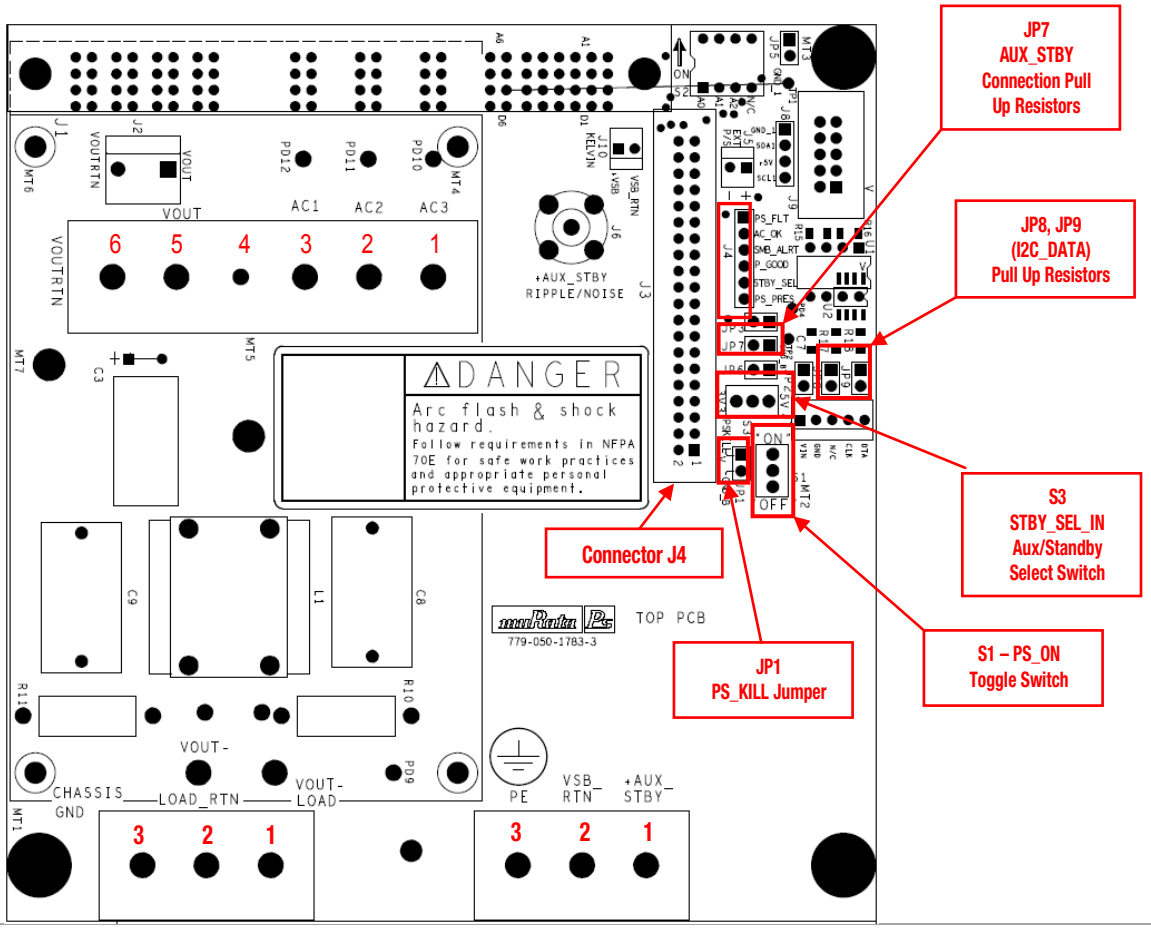
1. **Three phase AC within the range 180VAC to 528VAC; 50/60Hz**
2. **DC Output Voltage of 380VDC (nominal) 391VDC max.**

These voltage levels are considered as hazardous and life threatening. Therefore extreme care should be exercised to prevent direct (or accidental) contact with an energized "live" connected interface card; it is recommended that a safety enclosure should be provided to protect the End User in this respect.

Arc Flash Warning

In addition to voltage hazards there is an associated "arc hazard" possible when attempting to "disengage" an energized D2U5T rectifier from an interface connector card (or from a customer system).
In North America (US & Canada) & Europe the following codes apply:
USA; NFPA 70E (National Fire Prevention Association; Standard for Electrical Safety in the Workplace); details electrical safety requirements for employees.
Canada; CSA Z462 (Workplace Electrical Safety Standard); details electrical safety requirements for employees.
Europe; EU Directive 2006/95/EC Annex I Points 2 & 3
Appropriate Personal Protective Equipment (PPE) should be worn.

INTERFACE CARD OUTLINE AND COMPONENT PLACEMENT



Load Connector
- **Pin 1 VOUT- LOAD**
- **Pin 2 LOAD_RTN**
- **Pin 3 CHASSIS_GND**

+AUX_STBY Connector
- **Pin 1 is the (+3.3V or 5V)**
- **Pin 2 is the +AUX_STDBY_RTN**

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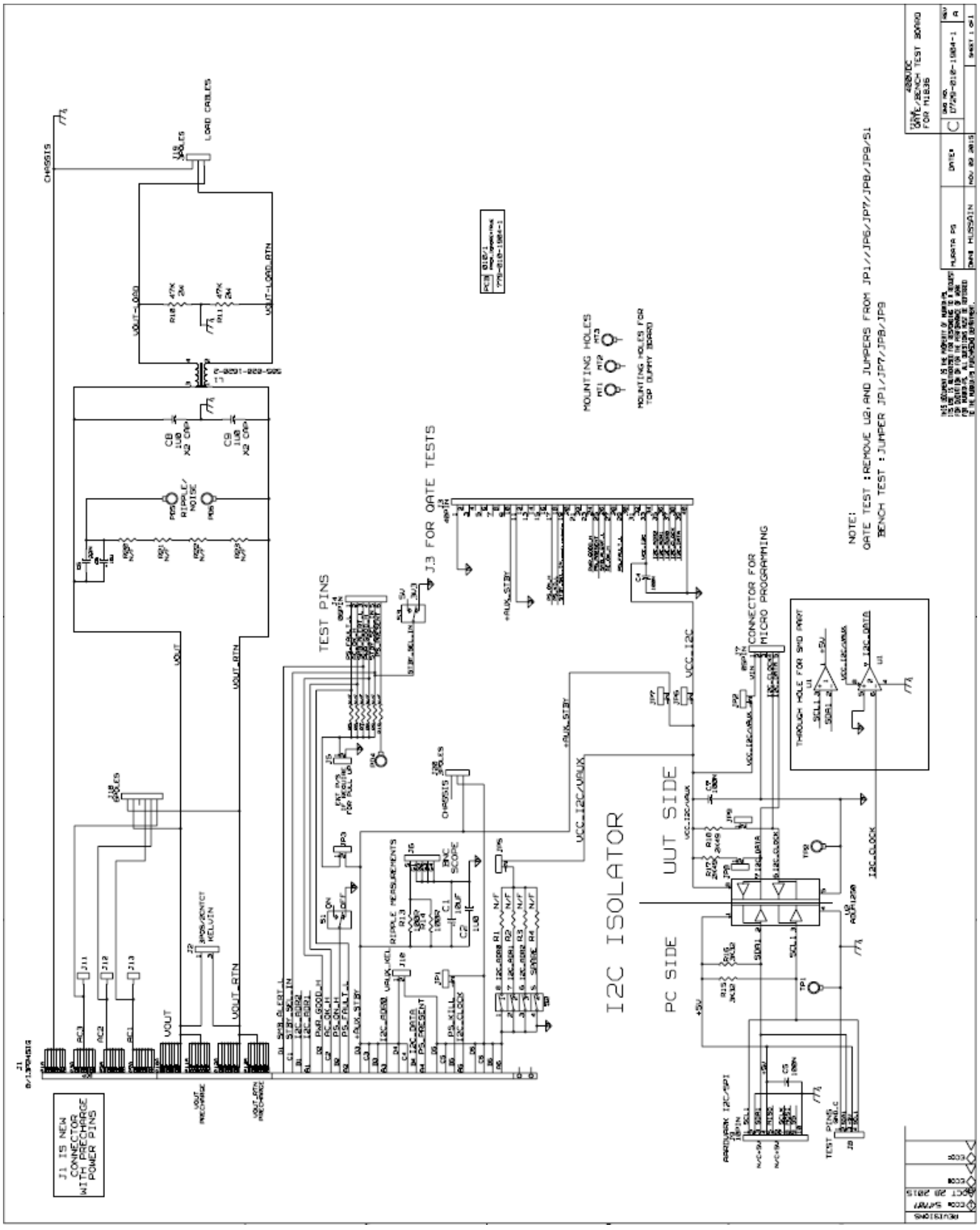
For full Details go to
www.murata-ps.com/rohs

SCHEMATIC


I2C ISOLATOR
PC SIDE
UUT SIDE
J3 FOR GATE TESTS
TEST PINS
MOUNTING HOLES
CONNECTOR FOR MICRO PROGRAMMING
LOAD CABLES
CHASSIS
VOUT
VOUT_RTN
I2C_CLOCK
VCC_I2C
VCC_I2C/VAUX
+AUX_STBY
J1 IS NEW CONNECTOR WITH PRECHARGE POWER PINS
NOTE:
GATE TEST : REMOVE U2, AND JUMPERS FROM JP1//JP6/JP7/JP8/JP9/S1
BENCH TEST : JUMPER JP1/JP7/JP8/JP9

USER CONFIGURATION NOTES

BEFORE ATTEMPTING ANY CONNECTIONS OR CONFIGURATION OF THE INTERFACE CARD ENSURE THAT THE INCOMING THREE PHASE AC SOURCE HAS BEEN SWITCHED OFF (REMOVED) AND ENSURE THAT THE 380VDC OUTPUT HAS FULLY DISCHARGED.

1. Ensure that the following configurable jumpers (headers) have shorting links (shunts Dual Beam; TE Connectivity Pt# 390088-2) fitted across their respective Pins 1 & 2 (refer to schematic):
   a) JP1 (PSKILL to STBY_RTN)
   b) JP7 (+AUX_STBY connection)
   c) JP8 (I2C_DATA) pull up resistor
   d) JP9 (I2C_CLOCK) pull up resistor

2. A 6 position screw terminal block that provides the following terminations:

Terminal Block Screw Number	Name & Function	Comments
#3	AC3; Phase connection "3"	These terminals are intended to connect the incoming three phase AC source that ranges from 180VAC to 528VAC (phase to phase voltage). As such these voltage levels are considered hazardous and safety precautions should be observed (see Safety Warning Section of this document. Each phase cable should be rated to withstand at least 600VAC and at least 12AWG (3.31mm^2) Each cable should be correctly terminated with an insulated crimped ring terminal suitable for the above cable gauge with a clearance hole for a 4.0mm (0.158") screw diameter. Consult appropriate local electrical codes and safety regulations.
#2	AC2; Phase connection "2"	
#1	AC1; Phase connection "1"	
#4	NO USER CONNECTION	This terminal screw #4 is intended as a "barrier" between the incoming AC Three Phase Source and the High Voltage DC Output. The End User shall make no connection to this terminal screw.
#5	VOUT Connection Terminal	These terminals are intended to connect the Main 380VDC output. As such this is considered as hazardous and safety precautions should be observed (see Safety Warning Section of this document. The output is "floating" with respect to earth/ground and employs a high impedance ground/centre point that consists of a nominal 40K ohm resistor connected between each output terminal and earth/ground (see schematic reference R10 & R11). This method is employed to limit the fault current flow if a "ground/earth" fault develops. Any measurement (and measuring device) should be differential and capable of withstanding at least the maximum output voltage (380VDC) to ground. Cables and ring terminals rated to withstand at least 600VAC and at least 10AWG (5.26mm^2); suitable for 4.0mm (0.158") screw diameter. Consult appropriate local electrical codes and safety regulations.
#6	VOUTRTN Connection Terminal	

3. The +VE" Connection Terminal and VOUTRTN "-VE" Connection rails are connected via common mode filter comprised by L1 and C8/C9 to a separate "Load Connector" that comprises a three position connector as follows:
   a) VOUT-LOAD
   b) LOAD_RTN
   c) CHASSIS_GND
   Cables and ring terminals rated to withstand at least 600VAC and at least 12AWG (3.31mm^2); suitable for 4.0mm (0.158") screw diameter.

4. AUX_STDBY Connector for the AUX_STBY output:
   Pin 1 is the +AUX_STBY connection (+3.3V or 5V dependent on the selection of S3- see below)
   Pin 2 is the +AUX_STBY_RTN
   Cables should be a minimum of 18AWG for the AUX_STBY connections; terminated in a ring terminal that will accept a 4.0mm (0.158") screw diameter.

Pin 3 is CHASSIS GROUND; note that this terminal should be connected to Protective Earth (PE) and represents the main PE connection to the interface card (the High Impedance Ground/Centre point relies on this incoming connection).
Connection cables should be a minimum of 12AWG for the CHASSIS GROUND connection; terminated in a ring terminal that will accept a 4.0mm (0.158") screw diameter.

5. J6 is a BNC connector for ripple & noise measurements of AUX_STBY and is intended for direct (BNC to BNC) connection (or via a 10X probe if required) to an oscilloscope; (note that J6 has a series 50ohm resistance formed by a parallel combination of R13//R14- see schematic).
   Note also that the measurement node is filtered with a parallel connected 10µF tantalum and 1µF ceramic capacitor (across tip to ground); the measurement bandwidth shall be limited to 20MHz.

6. Connector J9 is a Total Phase Aardvark I^{2}C/SPI compatible interface connector. The "Aardvark" external device allows communications via a USB port of a laptop or PC that can be used with the proprietary Aardvark Control Centre™ software GUI. The interface to the power module is buffered via an I^{2}C Isolator device (Analog Devices ADµM1250) that is connected to J9 (see schematic). This device (U2) isolates and level shifts the Serial Clock (SCL) and Serial Data (SDA) lines respectively to facilitate trouble free communication between "host" and UUT.
   Note that in this context the I^{2}C bus that U2 "isolates" is itself galvanically isolated from any hazardous voltage levels (actually referenced to +AUX_STBY return).

USER CONFIGURATION NOTES

Three (3) User Configurable switches are provided:

a) S1 toggles the PS_ON Signal to allow the User to readily turn on/off the Main 380VDC output; the switch is annotated "ON" and "OFF"; toggling the switch between these positions turns the Main output on/off accordingly.

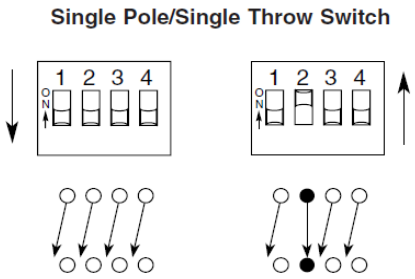
b) The rectifier power module has selectable +AUX_STBY voltage rail being either 3.3V or 5V.
S3 toggles the STBY_SEL_IN signal line to select the appropriate +AUX_STBY voltage; the switch is annotated "3V3" and "5V" and toggling the switch between these positions selects the appropriate voltage.
The position of S3 should be selected before the application of AC power to the rectifier; **it is not recommended to operate S3 (between the 3.3V and 5V positions) while the rectifier is operational.**
Toggling from the 3.3V to 5V setting while operational shall cause the +AUX_STBY to initiate an OVP of the output.
Toggling the 5V to 3.3V setting while operational shall cause no damage to the rectifier however the output shall revert to 3.3V operation and this may have an undesired effect if powering End User electronics.

c) S2 is a four (4) position DIL switch that is intended to select the User configurable bits that assign the variable address for I^2C communications with the rectifier.
Note that address bits A0, A1, & A2 are internally connected by a 10K ohm pull up resistor to VDD (either 3.3V or 5V dependent upon the selection of S3).
The required address should be set before power is applied to the rectifier (no change of address is possible while power is applied).
The following Table illustrates the possible address combinations possible by operation of S2:

S4 Position #3 (A2) (Serial Address BIT 2)	S4 Position #2 (A1) (Serial Address BIT 1)	S4 Position #1 (A0) (Serial Address BIT 0)	Power Module Main Controller (Serial Comm Slave Address)	Power Module Main EEPROM (Serial Comm Slave Address)
LOW	LOW	LOW	0xB0	0xA0
LOW	LOW	HIGH	0xB2	0xA2
LOW	HIGH	LOW	0xB4	0xA4
LOW	HIGH	HIGH	0xB6	0xA6
HIGH	LOW	LOW	0xB8	0xA8
HIGH	LOW	HIGH	0xBA	0xAA
HIGH	HIGH	LOW	0xBC	0xAC
HIGH	HIGH	HIGH	0xBE	0xAE

The address convention uses 7-bit left shifted Slave Device addressing with the Read/Write bit either a "0" (Write) or a "1" (Read). The addresses above assume the Read/Write bit is a "0".

S2 is shown in the diagram opposite (also refer to the schematic).
With any of the DIL switches (1, 2, & 3) set to the "off" (open) position, the corresponding address line (A0/A1/A2 respectively) shall be set to a logic level high (by action of the internal 10K ohm pull up resistor upon the Interface Connector Card.
Operating the appropriate switch to the "on" (closed) position will connect the appropriate line to a logic level low.
Note: The switch position DIL Position #4 is unused and has no connection (NC) on the interface connector card.



7. If required connector J4 can be used to monitor the status of I/O signals generated by the rectifier power module. Each pin is internally connected by a 10K ohm pull up resistor to VDD (either 3.3V or 5V dependent upon the selection of S3). All signals are considered as SELV (<60VDC)
The following table shows the pin assignments for the relevant signals and their description.

Signal (I/O)	Description
PS_FAULT_L (Output)	Internal 10K pull-up resistor to internal VDD. PSU Fault Status
PWR_GOOD_H (Output)	Internal 10K pull-up resistor to internal VDD. Main Output Status OK
STBY_SEL_IN (Input)	Internal 10K pull-up resistor to internal VDD. Leaving signal pin open = +5V STBY Tying signal pin to GND = 3V3STBY
AC_OK_H (Output)	Internal 10K pull-up resistor to internal VDD. AC OK Status
SMB_ALERT_L (Output)	Internal 10K pull-up resistor to internal VDD. SMB Alert signal output
PS_PRESENT_L (Output)	A direct connection to +AUX_STBY_RTN