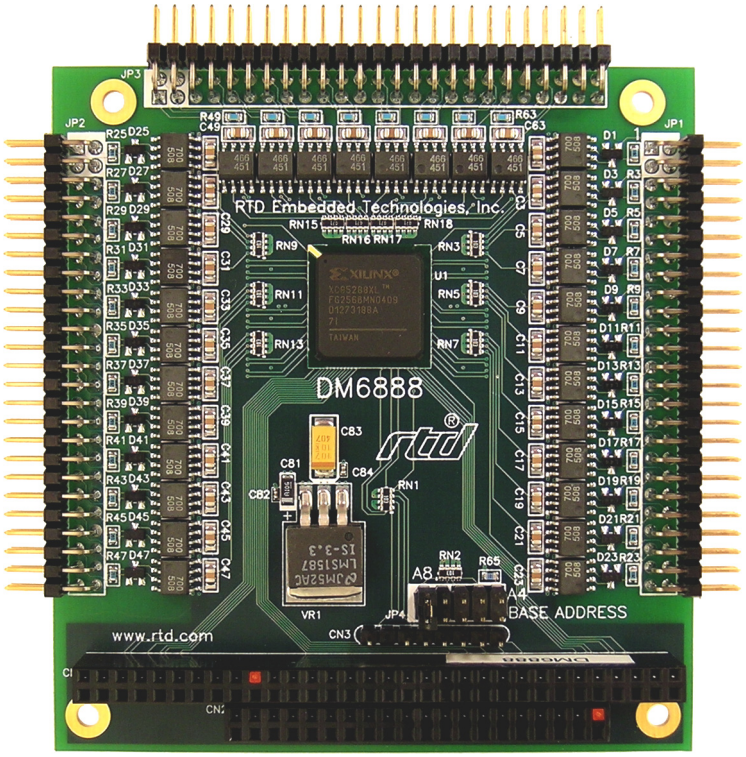
# DM6888HR 64-Channel, High Density Isolated Digital I/O dataModule®




## User's Manual

**BDM-610010031 Revision F**

**www.rtd.com**

**An ISO9001:2000 Company**

"Accessing the Analog World"®

# DM6888HR 64-Channel, High Density Isolated Digital I/O dataModule® User's Manual

RTD Document Number: BDM-610010031 Revision F

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Contents and specifications within this manual are subject to change without notice.

## Revision History

| Revision | Date | Reason for Change |
|---|---|---|
| A | 7/6/02 | Initial release. |
| B | 00/00/00 | Improved layout and content organization; enhanced content. |
| C | 5/22/07 | Updated Figure 6 and Figure 7 |
| D | 11/05/08 | Corrected *Special Considerations* on page 21 |
| E | 5/26/09 | Corrected pinout: Table 9, *IDAN-DM6888-62D—62-Pin D Subminiature Connector (female)* — 25<br>Corrected pinout: Table 10, *IDAN-DM6888-68D—68-Pin High Density D Connector (female)* — 28<br>Specified "GND12" in both pinout tables |
| F | 5/28/09 | Updated descriptions throughout to account for the +5V, +12V, and +24V ordering options<br>Corrected signal directions in labels on Figure 1, *DM6888HR dataModule (top view)* — 2 and in module description in *DM6888HR Ordering Information* on page 3<br>Removed sentence about NC, NO, and C relay connections under *Mechanical Description* on page 5<br>Update IDAN diagrams to show dimensions and include back-side P4 connector<br>Changes to Table 9 and Table 10<br>Add descriptive paragraph to explain the tables<br>Corrected IDAN and DM6888 labels in table headers<br>Change pins 49 and 50 from "N/C" to "Reserved"<br>Add N/C pins 51-62 |

# DM6888HR 64-Channel, High Density Isolated Digital I/O dataModule®

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# Chapter 1 Introduction

The PC/104 compliant DM6888HR dataModule combines 48 opto-isolated digital inputs and 16 opto-isolated digital outputs on one board. The inputs are factory configured for a +5, +12, or +24V input range (customized input range available upon request). A Schottky reverse voltage protection diode improves system reliability. The DM6888HR outputs have an open collector configuration. A pull-up resistor is factory installed for a +5 V nominal output range. The output stage of the opto-coupler can drive up to 8 mA with a maximum voltage of 30 V. The outputs of the DM6888HR are inactive after reset and maintain their state even if the system is reset, thus preventing uncontrolled output operation in cases of system operation failure.

This manual is intended to help you install the DM6888HR dataModule and get it working quickly, while also providing enough detail about the board and its functions so you can get maximum use of its features even in the most demanding applications.

***Note*** *Read the specifications on page 6 prior to designing with the dataModule.*

This manual is organized as follows:

| | |
|---|---|
| **Chapter 1** | ***Introduction***<br>introduces main features and specifications |
| **Chapter 2** | ***DM6888HR Board Settings***<br>provides information on factory-default and user-configurable jumper settings |
| **Chapter 3** | ***Installing the dataModule***<br>provides information on installing the DM6888HR |
| **Chapter 4** | ***Programming the dataModule***<br>provides information on how to program your DM6888HR |
| **Appendix A** | ***IDAN™ Dimensions and Pinout***<br>provides connector pinouts for the DM6888HR installed in an RTD Intelligent Data Acquisition Node (IDAN™) frame |
| **Appendix B** | ***Limited Warranty*** |

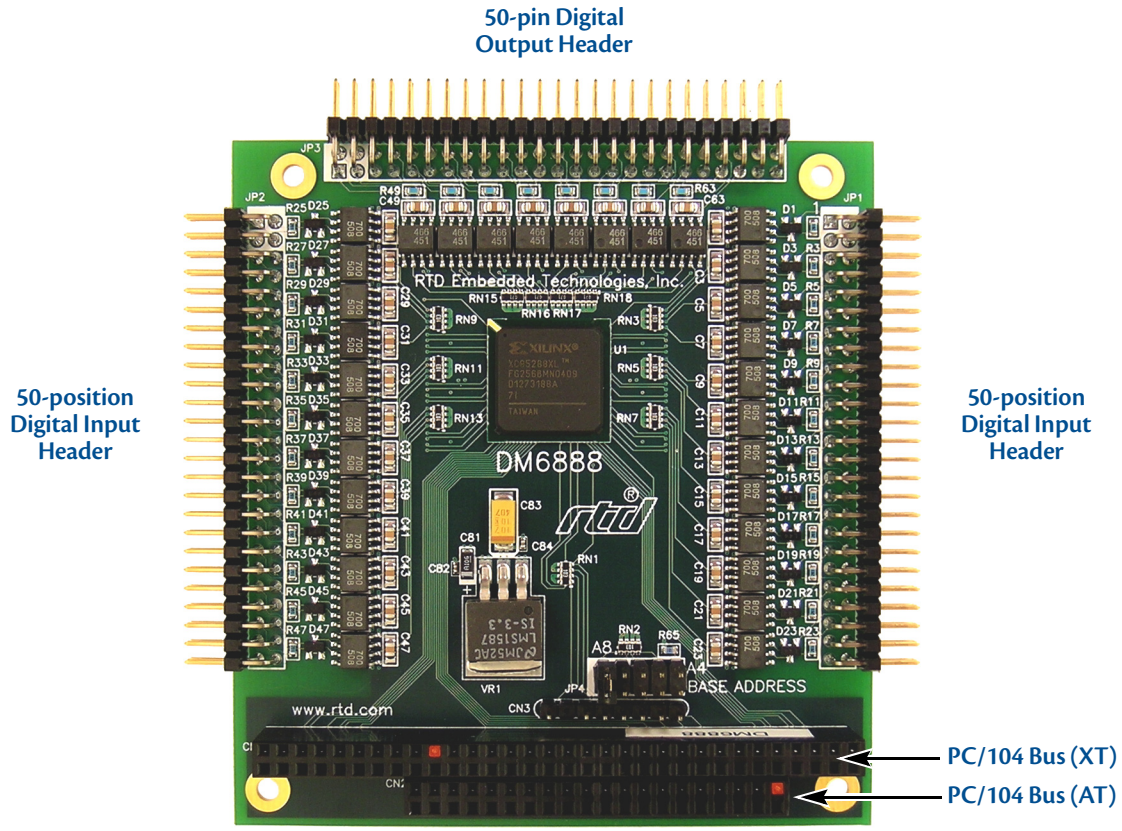


**Figure 1 DM6888HR dataModule (top view)**

# DM6888HR Ordering Information

The DM6888HR dataModule is available with standard 50-position 0.1-inch DIL headers for the two opto-isolated input headers and the one opto-isolated output connector. The input connectors are factory configured for optional +5, +12, or +24V input ranges (custom input range available upon request). These input ranges are selectable by the following model numbers:

- **DM6888HR-5V**: +5 V typical input range
- **DM6888HR-12V**: +12 V typical input range
- **DM6888HR-24V**: +124 V typical input range

The dataModule can also be purchased as part of an Intelligent Data Acquisition Node (IDAN™) building block, which consists of the dataModule and a milled aluminum IDAN frame. The IDAN building block can be used in just about any combination with other IDAN building blocks to create a simple but rugged PC/104 stack. Refer to Appendix A, *IDAN™ Dimensions and Pinout*, for more information. The DM6888HR dataModule can also be purchased as part of a custom-built RTD HiDAN™ or HiDANplus High Reliability Intelligent Data Acquisition Node. Contact RTD for more information on its high reliability PC/PCI-104 systems.

Each DM6888HR package contains the following items:

- DM6888HR dataModule
- Companion CD containing software and documentation

## DM6888HR Accessories

In addition to the items included in your DM6888HR package, several software and hardware accessories are available. Hardware accessories include IDAN frames, power supplies, terminal boards, and other connection systems. Contact RTD or your distributor, or visit the RTD website at www.rtd.com, for more information and for advice on selecting the most appropriate application software and drivers and hardware accessories to support your control system.

**Table 1 Recommended Accessories[1]**

| Part Number | Description |
|---|---|
| XT50 | 3-foot, 50-pin, twisted-pair cable |
| TB50 | 50-pin screw terminal board |
| XB50 | 50-pin screw terminal extender board |

1. Refer to the RTD website (www.rtd.com) for more details.

# Features

Some of the key features of the fully compliant PC/104 DM6888HR dataModule include:

- Isolated inputs
  - 48 opto-isolated digital inputs
  - +5 V typical input range (DM6888HR-5V only)
    - On at +2.4 V, minimum
    - +15 V maximum input
  - +12 V typical input range (DM6888HR-12V only)
    - On at +7.9 V, minimum
    - +36 V maximum input
  - +24 V typical input range (DM6888HR-24V only)
    - On at +14.2 V, minimum
    - +50 V maximum input
  - Custom settings available
  - Reverse polarity protection
  - 1500 Vrms isolation
- Isolated outputs
  - 16 opto-isolated open-collector digital outputs
  - 4.7 kΩ pull-up resistor
  - Maximum output current: 8 mA (sink)
  - Maximum output voltage: 30 V
  - 1500 Vrms isolation
- Connectors
  - Isolated input and outputs: standard 50-position 0.1-inch DIL headers
- Physical and environmental
  - –40 to +85 °C operating temperature
  - RTD IDAN™ compatible (see Appendix A, *IDAN™ Dimensions and Pinout*)

## Opto-Isolated Digital Inputs

48 opto-isolated inputs may be used to connect high voltage signals to a computer. Three channel-by-channel isolated input ranges are available from the factory including +5V, +12V, +24V. Custom input ranges are available upon request. The opto-isolated inputs have a reverse voltage protection diode across the input. This enables an AC connection to the inputs where the input diode acts as a rectifier.

## Opto-Isolated Digital Outputs

16 opto-isolated outputs may be used to directly drive loads, such as relays and lamps, or to interface to commonly encountered +24 V PLC I/Os. The outputs are driven with an open collector opto-isolated output capable of sinking 8 mA at 30 V. Each output channel can be connected to a different potential. The isolated outputs are controlled with a latch structure.

## Mechanical Description

The DM6888HR is designed on the PC/104 form factor for an easy mechanical interface to PC/104 systems. Stack your PC/104 compatible computer directly on the board using the onboard mounting holes. Opto-isolated digital inputs are split into two 50-pin headers containing 8 channels each. Opto-isolated digital outputs are grouped together into one 50-pin header connector located at the top of the module. Figure 2 shows a simplified block diagram of the DM6888HR dataModule.

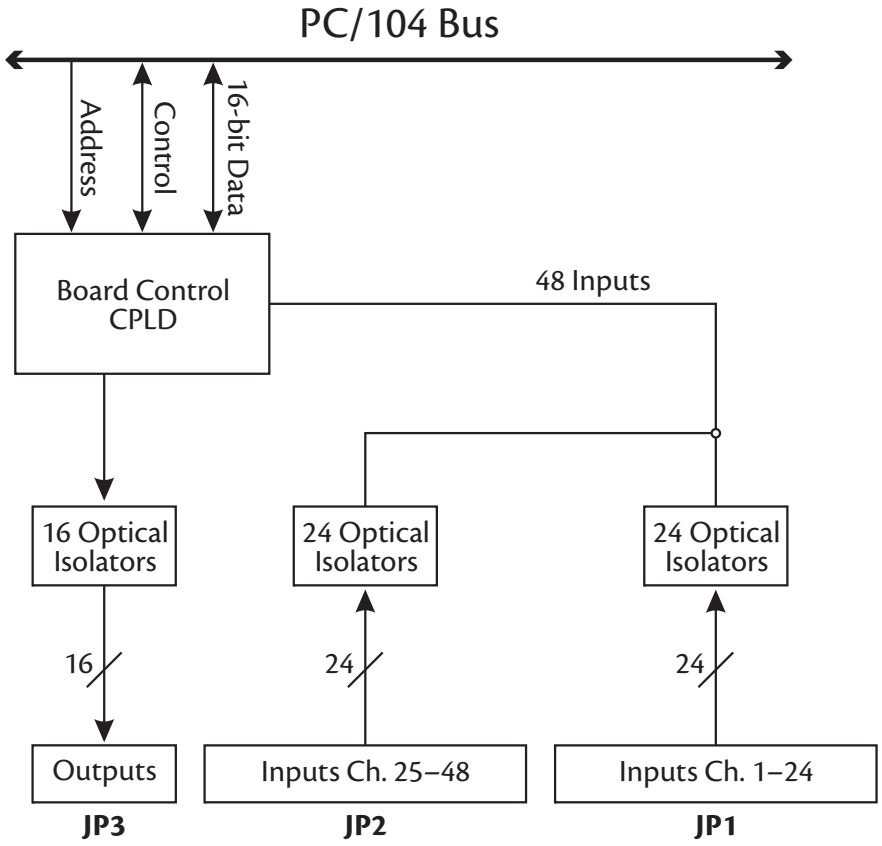


**Figure 2 DM6888HR dataModule Simplified Block Diagram**

# Specifications

## Host Interface

- Jumper selectable base address, I/O mapped

## Digital Inputs (isolated)

- Number of lines — 48
- DM6888HR-5V
  - Triggering voltage — +2.4 V (approx.)
  - Maximum input voltage — +15 V
- DM6888HR-12V
  - Triggering voltage — +7.9 V (approx.)
  - Maximum input voltage — +36 V
- DM6888HR-24V
  - Triggering voltage — +14.2 V (approx.)
  - Maximum input voltage — +36 V
- Isolation voltage — 1500 Vrms

## Digital Outputs (isolated)

- Number of lines — 16
- Isolation voltage — 1500 Vrms
- Output stage — Open collector with a 4.8 kΩ pull-up
  8 mA sink current, 30 V
- Output supply voltage — +5 to +30 V

## Connectors

- Isolated inputs (2) — 50-pin headers
- Isolated output (1) — 50 pin header
- Bus connectors — PC/104 XT and PC/104 AT

## Power Requirements

- Supply voltage — +5 V ± 8%

  Supply current 175 mA

## Operating Temperature Range

Standard — –40 to +85 °C

## For More Information

Contact RTD if you need further assistance.

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# Chapter 2 DM6888HR Board Settings

The jumper settings of the DM6888HR 64-channel, high density isolated digital I/O dataModule can be changed to suit your application. This chapter provides the DM6888HR factory default and base address jumper settings.

## Factory-Configured Jumper Settings

Figure 3 shows the dataModule layout and jumper locations. Table 2 provides the factory jumper settings for the DM6888HR. The following paragraphs explain how to change the factory jumper settings.

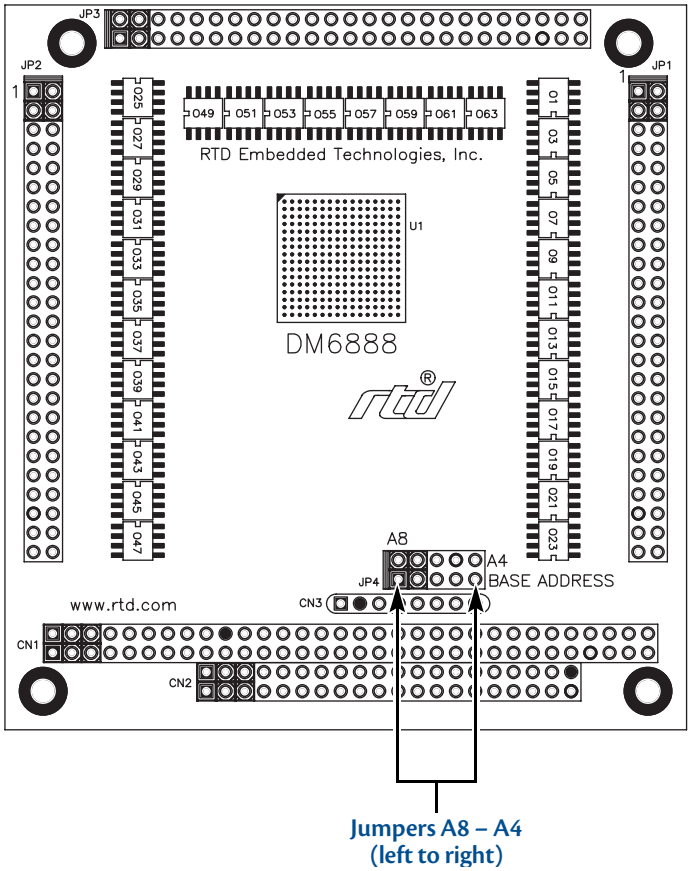



**Figure 3 DM6888HR Jumper Locations**

**Table 2 Factory Jumper Settings**

| Jumper Name | Jumper Description | Number of Jumpers | Factory Jumper Setting |
|---|---|---|---|
| BASE ADDRESS | Base address | 5 | 300h |

## Base Address Jumpers (Factory Setting: 300h)

The most common cause of failure when you are first setting up your dataModule is address contention. Some of your computer's I/O space is already occupied by other internal I/O devices and expansion boards. When the board attempts to use its own reserved I/O addresses, which are already being used by another peripheral device, erratic performance may occur and the data read from the board may be corrupted.

To avoid this problem make sure you set up the base address first by using the five jumpers (**A4** through **A8**) marked **BASE ADDRESS**. This allows you to choose from 32 different I/O addresses in your computer I/O map. If the factory-installed setting of 300h becomes unusable for your system configuration, you can change this setting using the options shown in Table 3, which shows the switch settings and their corresponding values in hexadecimal values. Ensure that you verify the correct location of the base address jumpers. Record the base address setting of the DM6888HR inside the back cover of this manual.

***Note*** *In Table 3, 1 = jumper installed, corresponding to a logical "1", and 0 = not jumpered, corresponding to a logical "0". The factory default base address is shaded.*

**Table 3 DM6888HR dataModule Base Address Jumper Settings**

| Base Address Hex/(Decimal) | Jumper Settings 8 7 6 5 4 | Base Address Hex/(Decimal) | Jumper Settings 8 7 6 5 4 |
|---|---|---|---|
| 200h/(512) | 0 0 0 0 0 | 300h/(768) | 1 0 0 0 0 |
| 210h/(528) | 0 0 0 0 1 | 310h/(784) | 1 0 0 0 1 |
| 220h/(544) | 0 0 0 1 0 | 320h/(800) | 1 0 0 1 0 |
| 230h/(560) | 0 0 0 1 1 | 330h/(816) | 1 0 0 1 1 |
| 240h/(576) | 0 0 1 0 0 | 340h/(832) | 1 0 1 0 0 |
| 250h/(592) | 0 0 1 0 1 | 350h/(848) | 1 0 1 0 1 |
| 260h/(608) | 0 0 1 1 0 | 360h/(864) | 1 0 1 1 0 |
| 270h/(624) | 0 0 1 1 1 | 370h/(880) | 1 0 1 1 1 |
| 280h/(640) | 0 1 0 0 0 | 380h/(896) | 1 1 0 0 0 |
| 290h/(656) | 0 1 0 0 1 | 390h/(912) | 1 1 0 0 1 |
| 2A0h/(672) | 0 1 0 1 0 | 3A0h/(928) | 1 1 0 1 0 |
| 2B0h/(688) | 0 1 0 1 1 | 3B0h/(944) | 1 1 0 1 1 |
| 2C0h/(704) | 0 1 1 0 0 | 3C0h/(960) | 1 1 1 0 0 |
| 2D0h/(720) | 0 1 1 0 1 | 3D0h/(976) | 1 1 1 0 1 |
| 2E0h/(736) | 0 1 1 1 0 | 3E0h/(922) | 1 1 1 1 0 |
| 2F0h/(752) | 0 1 1 1 1 | 3F0h/(1008) | 1 1 1 1 1 |

***Note*** *Not all possible address combinations are shown.*

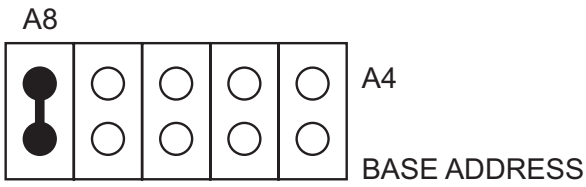



**Figure 4 Base Address Jumpers Set for 300h**

# Chapter 3 Installing the dataModule

The DM6888HR 64-channel, high density isolated digital I/O dataModule interfaces easily to PC/104 systems, such as industrial or automotive control systems. This chapter provides general installation guidelines for the DM6888HR dataModule.

After completing the installation, RTD recommends using the diagnostic software included in your DM6888HR package to fully verify that your module is working.

# DM6888HR Connectors

Figure 5 shows the connectors of the DM6888HR dataModule.

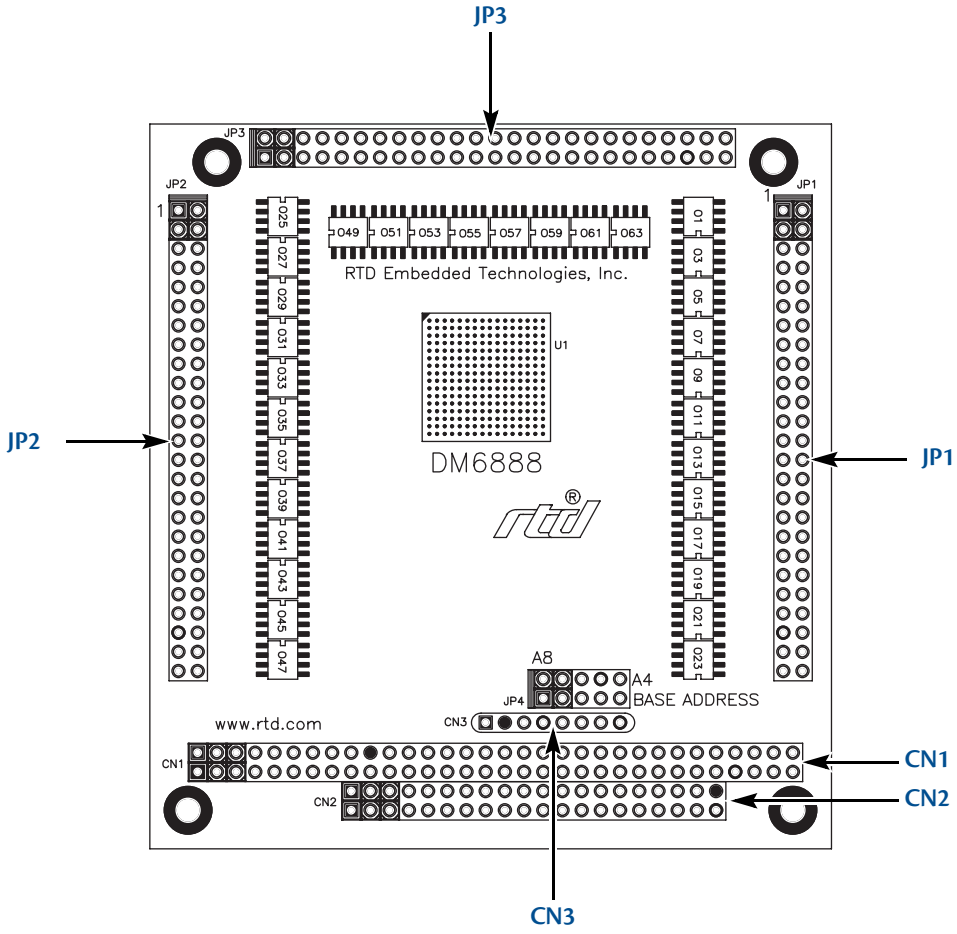



**Figure 5 DM6888HR Connector Locations**

***Note*** *Pin 1 of each connector is indicated by a square within a white square on both the top and bottom of the board. Pin 1 of the XT and AT connectors match when stacking with other PC/104 modules.*

**Table 4 DM6888HR Connectors**

| Connector | Function | Size |
|---|---|---|
| CN1 | PC/104 Bus (XT) | 64-pin |
| CN2 | PC/104 Bus (AT) | 40-pin |
| CN3 | Factory use only | 8-pin |
| JP2 | Left Input Connector | 50-pin |
| JP1 | Right Input Connector | 50-pin |
| JP3 | Output Connector | 50-pin |

# External I/O Connections

Table 5 below shows the connection pinouts for the identical input connectors, **JP2** (left input connector) and **JP1** (right input connector), with the dataModule oriented with the PC/104 (ISA) bus in the 6 o' clock position (toward the bottom). The DM6888HR can be connected to input devices using twisted pair, 50-pin flat cables or discrete wires.

**Table 5 Input Connector Pinouts (JP1 and JP2)**

| Connection | Pin | Pin | Connection |
|---|---|---|---|
| IN1+ | 1 | 2 | IN1– |
| IN2+ | 3 | 4 | IN2– |
| IN3+ | 5 | 6 | IN3– |
| IN4+ | 7 | 8 | IN4– |
| IN5+ | 9 | 10 | IN5– |
| IN6+ | 11 | 12 | IN6– |
| IN7+ | 13 | 14 | IN7– |
| IN8+ | 15 | 16 | IN8– |
| IN9+ | 17 | 18 | IN9– |
| IN10+ | 19 | 20 | IN10– |
| IN11+ | 21 | 22 | IN11– |
| IN12+ | 23 | 24 | IN12– |
| IN13+ | 25 | 26 | IN13– |
| IN14+ | 27 | 28 | IN14– |
| IN15+ | 29 | 30 | IN15– |
| IN16+ | 31 | 32 | IN16– |
| IN17+ | 33 | 34 | IN17– |
| IN18+ | 35 | 36 | IN18– |
| IN19+ | 37 | 38 | IN19– |
| IN20+ | 39 | 40 | IN20– |
| IN21+ | 41 | 42 | IN21– |
| IN22+ | 43 | 44 | IN22– |
| IN23+ | 45 | 46 | IN23– |
| IN24+ | 47 | 48 | IN24– |
| N/C | 49 | 50 | N/C |

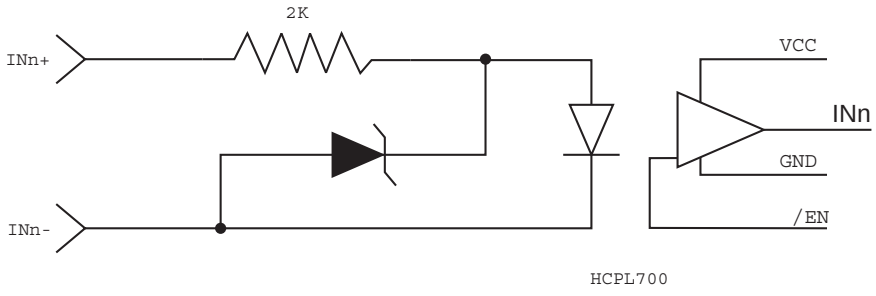



**Figure 6 Channel 1 Input Connection**

Table 6 shows the pinout for the output connector (**JP3**). With the DM6888HR oriented with the PC/104 (ISA) bus in the 9 o' clock position (toward the left), Pin 1 is to the left side and is marked with a square pad on the solder (bottom) side of the dataModule. The DM6888HR can be connected to an output device using a twisted pair, 50-pin flat cable or discrete wires.

***Note*** *Pin 1 of each connector is indicated by a square within a white square on both the top and bottom of the board.*

**Table 6 Output Connector Pinout (JP3)**

| JP3 (Output Connector) | | | |
|---|---|---|---|
| **Signal Description** | **Pin** | **Pin** | **Signal Description** |
| +Vsupply-1 | 1 | 2 | Out1 |
| GND-1 | 3 | 4 | +Vsupply-2 |
| Out2 | 5 | 6 | GND-2 |
| +Vsupply-3 | 7 | 8 | Out3 |
| GND-3 | 9 | 10 | +Vsupply-4 |
| Out4 | 11 | 12 | GND-4 |
| +Vsupply-5 | 13 | 14 | Out5 |
| GND-5 | 15 | 16 | +Vsupply-6 |
| Out6 | 17 | 18 | GND-6 |
| +Vsupply-7 | 19 | 20 | Out7 |
| GND-7 | 21 | 22 | +Vsupply-8 |
| Out8 | 23 | 24 | GND-8 |
| +Vsupply-9 | 25 | 26 | Out9 |
| GND-9 | 27 | 28 | +Vsupply-10 |
| Out10 | 29 | 30 | GND-10 |
| +Vsupply-11 | 31 | 32 | Out11 |
| GND-11 | 33 | 34 | +Vsupply-12 |
| Out12 | 35 | 36 | GND-12 |
| +Vsupply-13 | 37 | 38 | Out13 |
| GND-13 | 39 | 40 | +Vsupply-14 |
| Out14 | 41 | 42 | GND-14 |
| +Vsupply-15 | 43 | 44 | Out15 |
| GND-15 | 45 | 46 | +Vsupply-16 |
| Out16 | 47 | 48 | GND-16 |
| N/C | 49 | 50 | N/C |

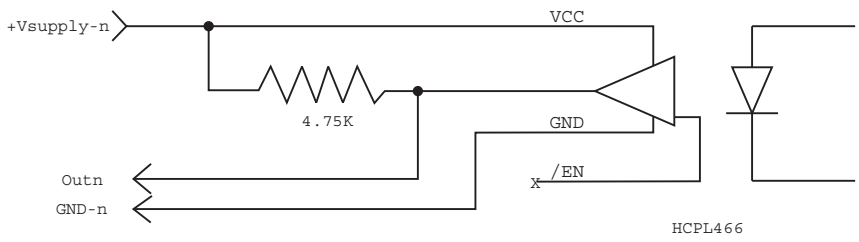



**Figure 7 Channel 1 Output Connection**

## Installation Considerations

Consider the following points before integrating the DM6888HR dataModule into a PC/104 stack.

1. The DM6888HR is a PC/104 module with an ISA bus (PC XT and AT connectors) and no PCI bus. Therefore, the DM6888HR should not be installed between a PC/104-Plus cpuModule and a PC/104-Plus peripheral module. Doing so would break the connection of the PC/104-Plus bus.
2. RTD recommends building your PC/104 computer by stacking the power supply module and cpuModule on the ends of the stack. These two modules produce heat, and stacking them on the top and bottom maximizes heat dissipation. Placing the cpuModule on one end of the stack also minimizes reflections. RTD-built PC/104 systems, such as the Intelligent Data Acquisition Node (IDAN™), normally have a power supply module on the bottom and a cpuModule on the top. Any other combination of PC/104 modules can be integrated into the stack.

## Before You Begin

***CAUTION*** *Keep your DM6888HR in the antistatic bag until you are ready to install it to your system!*

***Note*** *Incompatible jumper settings can result in unpredictable operation and erratic response.*

When removing the DM6888HR from the antistatic bag, hold it at the edges and do not touch the components or connectors. Please handle the module in an antistatic environment and use a grounded workbench for testing and handling. Before installing the DM6888HR in your computer, check the jumper settings. Refer to Chapter 2 for factory-default jumper settings and how to change them.

# Installing the DM6888HR in a PC/104 Stack

1. Turn off power to your PC/104 system and unplug the cord.
2. Ground yourself with an anti-static strap.
3. Set the Base Address as described in Chapter 2, *DM6888HR Board Settings*.

***CAUTION*** *The DM6888HR should slide into the matching PC/104 connector easily. Do not force the connection. Doing so might bend or break pins.*

4. Line up the pins of the DM6888HR's PC/104 connector with the PC/104 bus of the stack and gently press the module onto the stack.
5. If any modules are to be installed above the DM6888HR, install them.
6. Attach any necessary cables to the PC/104 stack.
7. Reconnect the power cord and apply power to the stack.
8. Boot the system and verify that all of the hardware is working properly.

# Chapter 4 Programming the dataModule

This chapter describes how to program and operate the DM6888HR dataModule. It provides a complete description of the I/O map, plus a detailed discussion of programming operations.

# Defining the I/O Map

Table 7 provides the I/O map of the DM6888HR. As shown, the module occupies two addresses. The Base Address (designated as BA) can be set using the jumpers as described in Chapter 2, *DM6888HR Board Settings*. The following sections describe the register contents of each address used in the I/O map.

**Table 7 DM6888HR I/O Map[1]**

| Register Description | Read | Write | Address (hex) |
|---|---|---|---|
| Output register #1 | Readback ch. 1–8 | Outputs ch. 1–8 | BA + 0x00h |
| Output register #2 | Readback ch. 9–16 | Outputs ch. 9–16 | BA + 0x01h |
| Input register #1 | Inputs ch. 1–8 | Not defined | BA + 0x02h |
| Input register #2 | Inputs ch. 9–16 | Not defined | BA + 0x03h |
| Input register #3 | Inputs ch. 17–24 | Not defined | BA + 0x04h |
| Input register #4 | Inputs ch. 25–32 | Not defined | BA + 0x05h |
| Input register #5 | Inputs ch. 33–40 | Not defined | BA + 0x06h |
| Input register #6 | Inputs ch. 41–48 | Not defined | BA + 0x07h |
| RTD ID | Read RTD ID Data | Not defined | BA + 400h |
| | Read RTD ID Data | Not defined | BA + 401h |
| | Reset RTD ID Pointer | Not defined | BA + 402h |

1. BA = Base Address.

## BA + 0x00h (0) Digital Outputs 1–8 (write/read)

The opto-isolated digital output channels 1–8 can be written through address **BA + 0x01**.

## BA + 0x01h (1) Digital Outputs 9–16 (write/read)

The opto-isolated digital output channels 9–16 can be written through address **BA + 0x02**.

## BA + 0x02h (2) to BA + 0x07h (7) Digital Inputs (write)

These data input registers return the input optocoupler data.

***Note*** *The registers can be read/written as 8-bit or 16-bit (even addresses only).*

## BA + 400h (1024)/BA + 401h (1025) RTD ID Data (read only, 8-bit or 16-bit)

RTD ID is a method to identify a board on the ISA bus. There are two 8-bit registers mapped at **BA + 400h** and **BA + 401h**. The registers can be read as two 8-bit or one 16-bit. An internal pointer is auto-incremented with every read to either address so the data read will step through each index as indicated in Table 8. The pointer is set to zero at reset.

**Table 8 RTD ID Data Read Indexes**

| Index | Data | 8-Bit Read | 16-Bit Read |
|---|---|---|---|
| 0 | Device ID | 88h | 6888h |
| 1 | Device ID | 68h | — |
| 2 | RTD Vendor ID | 35h | 1435h |
| 3 | RTD Vendor ID | 14h | — |
| 4 | EPLD Revision | Revision LSD | Revision |
| 5 | EPLD Revision | Revision MSD | — |
| 6–9 | Reserved | Ignore | Ignore |
| 10 | Board Name String | D | DM |
| 11 | Board Name String | M | — |
| 12 | Board Name String | 6 | 68 |
| 13 | Board Name String | 8 | — |
| 14 | Board Name String | 8 | 88 |
| 15 | Board Name String | 8 | — |
| 16 | Board Name String | <nul> | <nul><nul> |
| 17 | Board Name String | <nul> | — |
| 18–255 | Unused | FFh | FFFFh |

## BA + 402h (1026) RTD ID Reset Pointer (read only, 8-bit only)

A read to **BA + 402h** will set a pointer that determines what data will be read when you read **BA + 400h** and **BA + 401h**. The pointer is set to zero at reset.

# Controlling the DM6888HR via Software

## RTD Provided Software

The companion CD that shipped with your DM6888HR includes drivers and example programs for various operating systems. Newer versions of the software may also be available from RTD's website.

The drivers provide an easy-to-use programming interface to control the DM6888HR. The example programs demonstrate the DM6888HR's features and how to use the drivers. The companion CD also includes source code for sample programs, which you may use as a template to develop your own software.

Consult the documentation provided with each driver for information on how to install and use it.

## Direct Register Control

RTD recommends using the provided drivers and examples for your operating system to interface with the DM6888HR. However, if you are using an unsupported operating system, you may need to access the DM6888HR's registers directly.

***Note*** *Many modern operating systems have protection features that prevent user applications from directly manipulating device registers. Under such operating systems, it will be necessary to develop a driver that controls the DM6888HR on behalf of your application.*

Usually, manipulating the registers of the DM6888HR is done via I/O port read/write functions. Under DOS, this is typically done via the inp() and outp() functions. The following example (written in C) illustrates direct register access under DOS:

```
#define BASE_ADDRESS 0x300
unsigned char register_value;

// Read from digital inputs 1-8 at BA+2
register_value = inp(BASE_ADDRESS + 2);
printf("Value of digital inputs 1-8 is: %x", register_value);

// Write a value to the digital output at BA + 0
// Set the outputs to all '1'
register_value = 0xFF;
outp(BASE_ADDRESS + 0, register_value);
```

Many operating systems have their own equivalent of the inp() and outp() functions. Consult the operating system's documentation for information on how to properly program I/O ports.

## Special Considerations

When manipulating the registers of a board, you must be very careful to only affect the bits that need to be altered. Simply writing a value to a register can inadvertently change the state of a board. To manipulate specific bits in a register, you should use the bitwise AND/OR operators.

For example, if you wish to set bit 3 in a register, you should not simply write 0x08 to the register. Doing so will overwrite the value of all other bits in the register. A better approach is to do the following:

1. Read in the register.
2. Use the bitwise OR operator to set bit 3.
3. Write the modified value back to the register.

The above approach is illustrated in the following DOS example (written in C):

```
// Read the register into a variable
register_value = inp(REGISTER_ADDRESS);

// Set bit 3
register_value |= 0x08; // Binary 00001000

// Write the modified value to the register
outp(REGISTER_ADDRESS, register_value);
```

This example sets bit 3 without affecting any of the other bits in the register.

As another example, if you want to clear bit 3 of a register—without affecting the other bits—you can use the bitwise AND operator as shown in the following DOS example (written in C):

```
// Read the register into a variable
register_value = inp(REGISTER_ADDRESS);

// Clear bit 3
register_value &= 0xF7; // Binary 11110111

// Write the modified value back to the register
outp(REGISTER_ADDRESS, register_value);
```

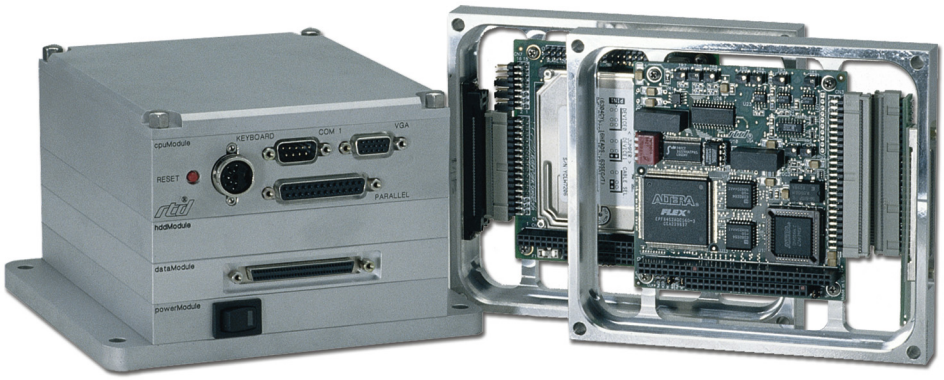
The above example will clear bit 3 without affecting any other bits in the register.

***Note*** *Be very careful to preserve the value of any bits marked as Reserved. The function of a reserved bit may change in future revisions of the DM6888HR. If your software manipulates a reserved bit, it may not be compatible with future board revisions.*

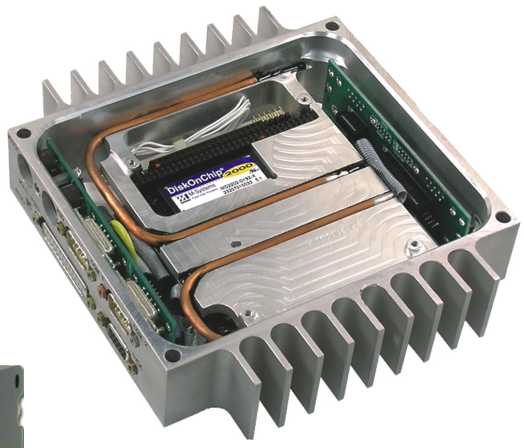
# Appendix A IDAN™ Dimensions and Pinout

dataModules, like all other RTD PC/PCI-104 modules, can be packaged in Intelligent Data Acquisition Node (IDAN) frames, which are milled aluminum frames with integrated heat sinks and heat pipes for fanless operation. RTD modules installed in IDAN frames are called building blocks. IDAN building blocks maintain the simple but rugged PC/104 stacking concept. Each RTD module is mounted in its own IDAN frame and all I/O connections are brought to the walls of each frame using standard PC connectors. No connections are made from module to module internal to the system other than through the PC/104 and PC/104-*Plus* bus, enabling quick interchangeability and system expansion without hours of rewiring and board redesign.

The DM6888HR dataModule can also be purchased as part of a custom-built RTD HiDAN™ or HiDAN*plus*™ High Reliability Intelligent Data Acquisition Node. This appendix provides the dimensions and pinouts of the DM6888HR installed in an IDAN frame. Contact RTD for more information on high reliability IDAN, HiDAN, and HiDAN*plus* PC/PCI-104 systems.




**IDAN—Adhering to the PC/104 stacking concept, IDAN allows you to build a customized system with any combination of RTD modules.**



**IDAN Heat Pipes—Advanced heat pipe technology maximizes heat transfer to heat sink fins.**

**HiDAN*plus*—Integrating the modularity of IDAN with the ruggedization of HiDAN, HiDANplus enables connectors on all system frames, with signals running between frames through a dedicated stack-through raceway.**

# IDAN-DM6888HR-62D

The IDAN-DM6888HR-62D is a DM6888HR dataModule packaged in an IDAN frame with three 62-pin D subminiature (female) I/O connectors.

## IDAN-DM6888HR-62D Dimensions and Connectors

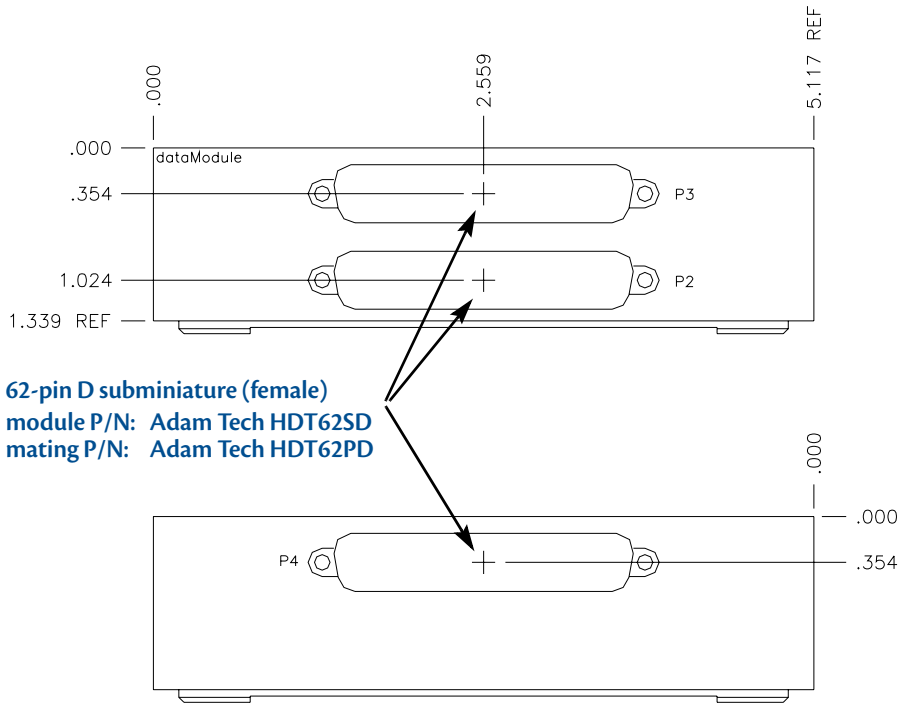



**Figure 8 IDAN-DM6888HR-62D Connectors**

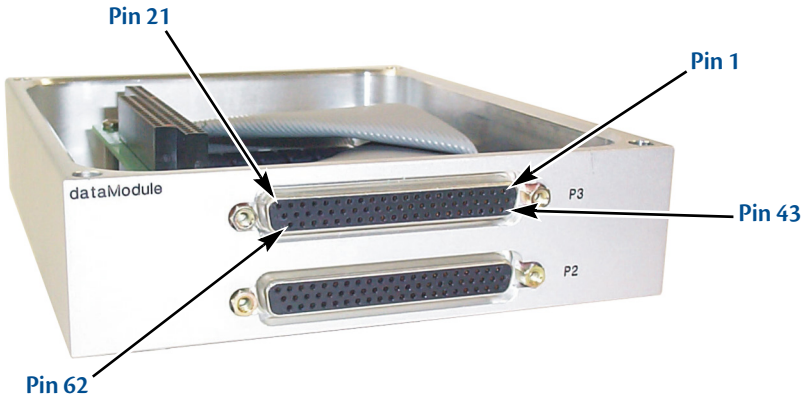



**Figure 9 IDAN-DM6888HR-62D Connector Pins**

***CAUTION*** *Do not make connections to reserved pins!*

***Note*** *Photographs are not to scale.*

## IDAN-DM6888-62D External I/O Connections

Cables within the IDAN unit provide signal connections between the exterior of the IDAN frame and the headers on the DM6888 module. IDAN ports P2, P3, and P4 connect to the DM6888 headers JP1, JP2, and JP3 respectively. The pin to pin mappings from IDAN port to DM6888 header are shown in the following table.

**Table 9 IDAN-DM6888-62D—62-Pin D Subminiature Connector (female)**

| IDAN P2 & P3 Pin # | | | Signal | DM6888 JP1 & JP2 Pin # | IDAN P4 Pin # | | | Signal | DM6888 JP3 Pin # |
|---|---|---|---|---|---|---|---|---|---|
| Row 1 | Row 2 | Row 3 | | | Row 1 | Row 2 | Row 3 | | |
| 1 | — | — | +IN1 | 1 | 1 | — | — | +Vsupply1 | 1 |
| — | 22 | — | –IN1 | 2 | — | 22 | — | OUT1 | 2 |
| — | — | 43 | +IN2 | 3 | — | — | 43 | GND | 3 |
| 2 | — | — | –IN2 | 4 | 2 | — | — | +Vsupply2 | 4 |
| — | 23 | — | +IN3 | 5 | — | 23 | — | OUT2 | 5 |
| — | — | 44 | –IN3 | 6 | — | — | 44 | GND | 6 |
| 3 | — | — | +IN4 | 7 | 3 | — | — | +Vsupply3 | 7 |
| — | 24 | — | –IN4 | 8 | — | 24 | — | OUT3 | 8 |
| — | — | 45 | +IN5 | 9 | — | — | 45 | GND | 9 |
| 4 | — | — | –IN5 | 10 | 4 | — | — | +Vsupply4 | 10 |
| — | 25 | — | +IN6 | 11 | — | 25 | — | OUT4 | 11 |
| — | — | 46 | –IN6 | 12 | — | — | 46 | GND | 12 |
| 5 | — | — | +IN7 | 13 | 5 | — | — | +Vsupply5 | 13 |
| — | 26 | — | –IN7 | 14 | — | 26 | — | OUT5 | 14 |
| — | — | 47 | +IN8 | 15 | — | — | 47 | GND | 15 |
| 6 | — | — | –IN8 | 16 | 6 | — | — | +Vsupply6 | 16 |
| — | 27 | — | +IN9 | 17 | — | 27 | — | OUT6 | 17 |
| — | — | 48 | –IN9 | 18 | — | — | 48 | GND6 | 18 |
| 7 | — | — | +IN10 | 19 | 7 | — | — | +Vsupply7 | 19 |
| — | 28 | — | –IN10 | 20 | — | 28 | — | OUT7 | 20 |
| — | — | 49 | +IN11 | 21 | — | — | 49 | GND7 | 21 |
| 8 | — | — | –IN11 | 22 | 8 | — | — | +Vsupply8 | 22 |
| — | 29 | — | +IN12 | 23 | — | 29 | — | OUT8 | 23 |
| — | — | 50 | –IN12 | 24 | — | — | 50 | GND8 | 24 |
| 9 | — | — | +IN13 | 25 | 9 | — | — | +Vsupply9 | 25 |
| — | 30 | — | –IN13 | 26 | — | 30 | — | OUT9 | 26 |
| — | — | 51 | +IN14 | 27 | — | — | 51 | GND9 | 27 |
| 10 | — | — | –IN14 | 28 | 10 | — | — | +Vsupply10 | 28 |
| — | 31 | — | +IN15 | 29 | — | 31 | — | OUT10 | 29 |
| — | — | 52 | –IN15 | 30 | — | — | 52 | GND10 | 30 |
| 11 | — | — | +IN16 | 31 | 11 | — | — | +Vsupply11 | 31 |
| — | 32 | — | –IN16 | 32 | — | 32 | — | OUT11 | 32 |
| — | — | 53 | +IN17 | 33 | — | — | 53 | GND11 | 33 |
| 12 | — | — | –IN17 | 34 | 12 | — | — | +Vsupply12 | 34 |
| — | 33 | — | +IN18 | 35 | — | 33 | — | OUT12 | 35 |
| — | — | 54 | –IN18 | 36 | — | — | 54 | GND12 | 36 |
| 13 | — | — | +IN19 | 37 | 13 | — | — | +Vsupply13 | 37 |
| — | 34 | — | –IN19 | 38 | — | 34 | — | OUT13 | 38 |
| — | — | 55 | +IN20 | 39 | — | — | 55 | GND13 | 39 |
| 14 | — | — | –IN20 | 40 | 14 | — | — | +Vsupply14 | 40 |
| — | 35 | — | +IN21 | 41 | — | 35 | — | OUT14 | 41 |
| — | — | 56 | –IN21 | 42 | — | — | 56 | GND14 | 42 |

**Table 9 IDAN-DM6888-62D—62-Pin D Subminiature Connector (female)**

| IDAN P2 & P3 Pin # | | | Signal | DM6888 JP1 & JP2 Pin # | IDAN P4 Pin # | | | Signal | DM6888 JP3 Pin # |
|---|---|---|---|---|---|---|---|---|---|
| 15 | — | — | +IN22 | 43 | 15 | — | — | +Vsupply15 | 43 |
| — | 36 | — | –IN22 | 44 | — | 36 | — | OUT15 | 44 |
| — | — | 57 | +IN23 | 45 | — | — | 57 | GND15 | 45 |
| 16 | — | — | –IN23 | 46 | 16 | — | — | +Vsupply16 | 46 |
| — | 37 | — | +IN24 | 47 | — | 37 | — | OUT16 | 47 |
| — | — | 58 | –IN24 | 48 | — | — | 58 | GND16 | 48 |
| 17 | — | — | Reserved | 49 | 17 | — | — | Reserved | 49 |
| — | 38 | — | Reserved | 50 | — | 38 | — | Reserved | 50 |
| — | — | 59 | N/C | — | — | — | 59 | N/C | — |
| 18 | — | — | N/C | — | 18 | — | — | N/C | — |
| — | 39 | — | N/C | — | — | 39 | — | N/C | — |
| — | — | 60 | N/C | — | — | — | 60 | N/C | — |
| 19 | — | — | N/C | — | 19 | — | — | N/C | — |
| — | 40 | — | N/C | — | — | 40 | — | N/C | — |
| — | — | 61 | N/C | — | — | — | 61 | N/C | — |
| 20 | — | — | N/C | — | 20 | — | — | N/C | — |
| — | 41 | — | N/C | — | — | 41 | — | N/C | — |
| — | — | 62 | N/C | — | — | — | 62 | N/C | — |
| 21 | — | — | N/C | — | 21 | — | — | N/C | — |
| — | 42 | — | N/C | — | — | 42 | — | N/C | — |

# IDAN-DM6888HR-68D

The IDAN-DM6888HR-68D is a DM6888HR dataModule packaged in an IDAN frame with three 68-pin high-density D (female) I/O connectors.

## IDAN-DM6888HR-68D Dimensions and Connectors

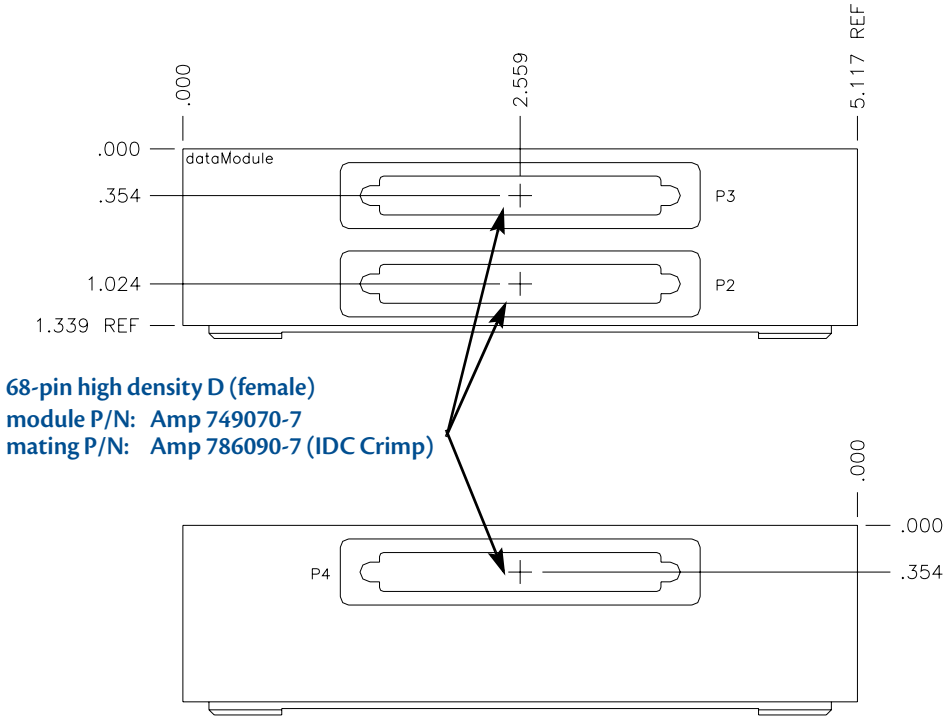



**Figure 10 IDAN-DM6888HR-68D Connectors**

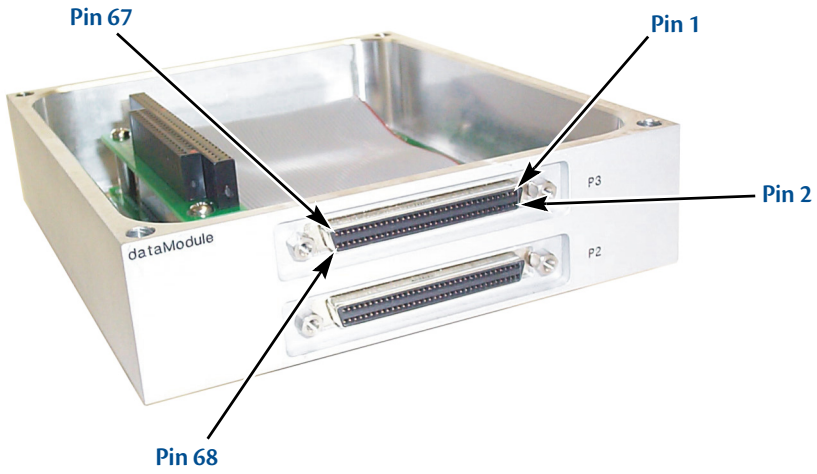



**Figure 11 IDAN-DM6888HR-68D Connector Pins**

***CAUTION*** *Do not make connections to reserved pins!*

***Note*** *Photographs are not to scale.*

## IDAN-DM6888-68D External I/O Connections

Cables within the IDAN unit provide signal connections between the exterior of the IDAN frame and the headers on the DM6888 module. IDAN ports P2, P3, and P4 connect to the DM6888 headers JP1, JP2, and JP3 respectively. The pin to pin mappings from IDAN port to DM6888 header are shown in the following table.

**Table 10 IDAN-DM6888-68D—68-Pin High Density D Connector (female)**

| IDAN P2 & P3 Pin # | | Signal | DM6888 JP1 & JP2 Pin # | IDAN P4 Pin # | | Signal | DM6888 JP3 Pin # |
|---|---|---|---|---|---|---|---|
| Row 1 | Row 2 | | | Row 1 | Row 2 | | |
| 1 | — | +IN1 | 1 | 1 | — | +Vsupply1 | 1 |
| — | 2 | –IN1 | 2 | — | 2 | OUT1 | 2 |
| 3 | — | +IN2 | 3 | 3 | — | GND | 3 |
| — | 4 | –IN2 | 4 | — | 4 | +Vsupply2 | 4 |
| 5 | — | +IN3 | 5 | 5 | — | OUT2 | 5 |
| — | 6 | –IN3 | 6 | — | 6 | GND | 6 |
| 7 | — | +IN4 | 7 | 7 | — | +Vsupply3 | 7 |
| — | 8 | –IN4 | 8 | — | 8 | OUT3 | 8 |
| 9 | — | +IN5 | 9 | 9 | — | GND | 9 |
| — | 10 | –IN5 | 10 | — | 10 | +Vsupply4 | 10 |
| 11 | — | +IN6 | 11 | 11 | — | OUT4 | 11 |
| — | 12 | –IN6 | 12 | — | 12 | GND | 12 |
| 13 | — | +IN7 | 13 | 13 | — | +Vsupply5 | 13 |
| — | 14 | –IN7 | 14 | — | 14 | OUT5 | 14 |
| 15 | — | +IN8 | 15 | 15 | — | GND | 15 |
| — | 16 | –IN8 | 16 | — | 16 | +Vsupply6 | 16 |
| 17 | — | +IN9 | 17 | 17 | — | OUT6 | 17 |
| — | 18 | –IN9 | 18 | — | 18 | GND6 | 18 |
| 19 | — | +IN10 | 19 | 19 | — | +Vsupply7 | 19 |
| — | 20 | –IN10 | 20 | — | 20 | OUT7 | 20 |
| 21 | — | +IN11 | 21 | 21 | — | GND7 | 21 |
| — | 22 | –IN11 | 22 | — | 22 | +Vsupply8 | 22 |
| 23 | — | +IN12 | 23 | 23 | — | OUT8 | 23 |
| — | 24 | –IN12 | 24 | — | 24 | GND8 | 24 |
| 25 | — | +IN13 | 25 | 25 | — | +Vsupply9 | 25 |
| — | 26 | –IN13 | 26 | — | 26 | OUT9 | 26 |
| 27 | — | +IN14 | 27 | 27 | — | GND9 | 27 |
| — | 28 | –IN14 | 28 | — | 28 | +Vsupply10 | 28 |
| 29 | — | +IN15 | 29 | 29 | — | OUT10 | 29 |
| — | 30 | –IN15 | 30 | — | 30 | GND10 | 30 |
| 31 | — | +IN16 | 31 | 31 | — | +Vsupply11 | 31 |
| — | 32 | –IN16 | 32 | — | 32 | OUT11 | 32 |
| 33 | — | +IN17 | 33 | 33 | — | GND11 | 33 |
| — | 34 | –IN17 | 34 | — | 34 | +Vsupply12 | 34 |
| 35 | — | +IN18 | 35 | 35 | — | OUT12 | 35 |
| — | 36 | –IN18 | 36 | — | 36 | GND12 | 36 |
| 37 | — | +IN19 | 37 | 37 | — | +Vsupply13 | 37 |
| — | 38 | –IN19 | 38 | — | 38 | OUT13 | 38 |
| 39 | — | +IN20 | 39 | 39 | — | GND13 | 39 |

**Table 10 IDAN-DM6888-68D—68-Pin High Density D Connector (female)**

| IDAN P2 & P3 Pin # | | Signal | DM6888 JP1 & JP2 Pin # | IDAN P4 Pin # | | Signal | DM6888 JP3 Pin # |
|---|---|---|---|---|---|---|---|
| — | 40 | –IN20 | 40 | — | 40 | +Vsupply14 | 40 |
| 41 | — | +IN21 | 41 | 41 | — | OUT14 | 41 |
| — | 42 | –IN21 | 42 | — | 42 | GND14 | 42 |
| 43 | — | +IN22 | 43 | 43 | — | +Vsupply15 | 43 |
| — | 44 | –IN22 | 44 | — | 44 | OUT15 | 44 |
| 45 | — | +IN23 | 45 | 45 | — | GND15 | 45 |
| — | 46 | –IN23 | 46 | — | 46 | +Vsupply16 | 46 |
| 47 | — | +IN24 | 47 | 47 | — | OUT16 | 47 |
| — | 48 | –IN24 | 48 | — | 48 | GND16 | 48 |
| 49 | — | Reserved | 49 | 49 | — | Reserved | 49 |
| — | 50 | Reserved | 50 | — | 50 | Reserved | 50 |
| 51 | — | N/C | — | 51 | — | N/C | — |
| — | 52 | N/C | — | — | 52 | N/C | — |
| 53 | — | N/C | — | 53 | — | N/C | — |
| — | 54 | N/C | — | — | 54 | N/C | — |
| 55 | — | N/C | — | 55 | — | N/C | — |
| — | 56 | N/C | — | — | 56 | N/C | — |
| 57 | — | N/C | — | 57 | — | N/C | — |
| — | 58 | N/C | — | — | 58 | N/C | — |
| 59 | — | N/C | — | 59 | — | N/C | — |
| — | 60 | N/C | — | — | 60 | N/C | — |
| 61 | — | N/C | — | 61 | — | N/C | — |
| — | 62 | N/C | — | — | 62 | N/C | — |

# Appendix B Limited Warranty

RTD Embedded Technologies, Inc. warrants the hardware and software products it manufactures and produces to be free from defects in materials and workmanship for one year following the date of shipment from RTD Embedded Technologies, Inc. This warranty is limited to the original purchaser of product and is not transferable.

During the one year warranty period, RTD Embedded Technologies will repair or replace, at its option, any defective products or parts at no additional charge, provided that the product is returned, shipping prepaid, to RTD Embedded Technologies. All replaced parts and products become the property of RTD Embedded Technologies. Before returning any product for repair, customers are required to contact the factory for a Return Material Authorization number.

This limited warranty does not extend to any products which have been damaged as a result of accident, misuse, abuse (such as: use of incorrect input voltages, improper or insufficient ventilation, failure to follow the operating instructions that are provided by RTD Embedded Technologies, "acts of god" or other contingencies beyond the control of RTD Embedded Technologies), or as a result of service or modification by anyone other than RTD Embedded Technologies. Except as expressly set forth above, no other warranties are expressed or implied, including, but not limited to, any implied warranties of merchantability and fitness for a particular purpose, and RTD Embedded Technologies expressly disclaims all warranties not stated herein. All implied warranties, including implied warranties for merchantability and fitness for a particular purpose, are limited to the duration of this warranty. In the event the product is not free from defects as warranted above, the purchaser's sole remedy shall be repair or replacement as provided above. Under no circumstances will RTD Embedded Technologies be liable to the purchaser or any user for any damages, including any incidental or consequential damages, expenses, lost profits, lost savings, or other damages arising out of the use or inability to use the product.

Some states do not allow the exclusion or limitation of incidental or consequential damages for consumer products, and some states do not allow limitations on how long an implied warranty lasts, so the above limitations or exclusions may not apply to you.

This warranty gives you specific legal rights, and you may also have other rights which vary from state to state.

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