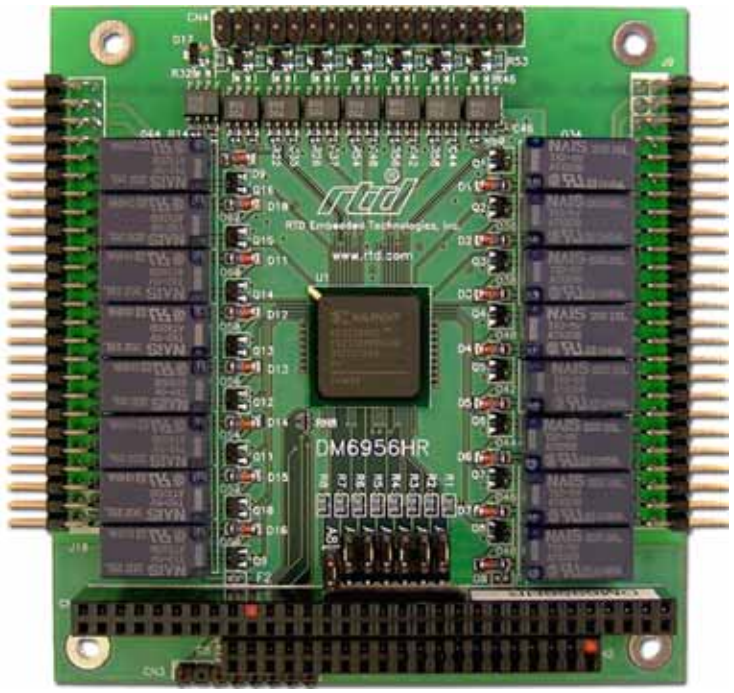
DM6956HR Opto-Isolated Input/ Power Relay Output dataModule®



User's Manual

BDM-610010030 Revision B

www.rtd.com

An ISO9001:2000 Company

"Accessing the Analog World"®

DM6956HR Opto-Isolated Input/Power Relay Output dataModule® User's Manual

RTD Document Number: BDM-610010030 Revision B

Copyright © 2005 RTD Embedded Technologies, Inc. All rights reserved.

Trademarks

Advanced Digital I/O, aDIO, a2DIO, Autonomous SmartCal, cpuModule, dspFramework, dspModule, IDAN, HiDAN, HiDANplus, "MIL Value for COTS prices", multiPort, and PC/104EZ are trademarks, and "Accessing the Analog World", dataModule, RTD, and the RTD logo are registered trademarks of RTD Embedded Technologies, Inc. PS/2, PC/XT, PC/AT, and IBM are trademarks of International Business Machines Inc. MS-DOS, Windows, Windows 95, Windows 98, and Windows NT are trademarks of Microsoft Corp. Linux is a registered trademark of Linus Torvalds. M-Systems and DiskOnChip are trademarks or registered trademarks of M-Systems Flash Disk Pioneers, Ltd. PC/104 is a registered trademark of PC/104 Consortium. All other trademarks appearing in this document are the property of their respective owners.

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	11/23/05	New layout and content organization; enhanced content.

DM6956HR Opto-Isolated Input/ Power Relay Output dataModule®

www.rtd.com

An ISO9001:2000 Company

"Accessing the Analog World"®

Contact Information

RTD Embedded Technologies, Inc.
103 Innovation Blvd.
State College, PA 16803-0906
USA

Phone: +1-814-234-8087
Fax: +1-814-234-5218

E-mail: sales@rtd.com
techsupport@rtd.com

Internet: http://www.rtd.com

Table of Contents

Chapter 1 Introduction

DM6956HR Ordering Information 3
- DM6956HR Model Options 3
- DM6956HR Accessories 3

Features 4
- Opto-Isolated Inputs 5
- Power Relay Outputs 5
- Resets 5
- Mechanical Description 6

Specifications 7
- Host Interface 7
- Power Relay Outputs 7
- Opto-Isolated Inputs 7
- Connectors 7
- Power Requirements 7
- Operating Temperature Range 7

For More Information 8

Chapter 2 DM6956HR Board Settings

Factory-Configured Jumper Settings 9
- Base Address Jumpers (Factory Setting: 300h) 10

Chapter 3 Installing the dataModule

DM6956HR Connectors 12

External I/O Connections 13

Installation Considerations 15

Before You Begin 15

Installing the DM6956HR in a PC/104 Stack 16

Chapter 4 Programming the dataModule

Defining the I/O Map 18
- BA + 0 Digital Outputs (write/read, 8-bit or 16-bit) 18
- BA + 1 Digital Outputs (write/read, 8-bit only) 18
- BA + 2 Digital Inputs (read only, 8-bit or 16-bit) 18
- BA + 3 Digital Inputs (read only, 8-bit only) 18
- BA + 400h/BA + 401h RTD ID Data (read only, 8-bit or 16-bit) 19
- BA + 402h RTD ID Reset Pointer (read only, 8-bit only) 19

Controlling the DM6956HR via Software 20
RTD Provided Software 20
Direct Register Control 20
Special Considerations 21

Appendix A IDAN™ Dimensions and Pinouts

IDAN-DM6956HR-62D 24
IDAN-DM6956HR-62D Dimensions and Connectors 24
IDAN-DM6956HR-62D External I/O Connections 26
IDAN-DM6956HR-68D 28
IDAN-DM6956HR-68D Dimensions and Connectors 28
IDAN-DM6956HR-68D External I/O Connections 30

Appendix B Limited Warranty

Chapter 1 Introduction

The PC/104 compliant DM6956HR dataModule combines 16 opto-isolated inputs and 16 power relay outputs on one board. The relays may be used to reliably switch voltages from +5 VDC up to +230 VAC. The onboard relays have two identical pairs of contacts, which are connected in parallel. Both Normally Open (NO) and Normally Closed (NC) contacts are available at the I/O connectors.

The DM6956HR dataModule can be used in applications such as AC or DC power circuit breaking, motor and actuator control, or voltage level shifting. The opto-isolated digital inputs are factory set for a +5 V input with triggering at +2.4 V. These inputs are reverse voltage protected and can accept inputs up to +15 V. The relay outputs are inactive after reset. The DM6956HR dataModule also has a "host reset disable" feature, which ensures that the outputs maintain their state even if the system is reset, thus preventing uncontrolled output operation in cases of accidental host system reset.

This manual is intended to help you install the DM6956HR 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 7 prior to designing with the dataModule.*

This manual is organized as follows:

Chapter 1	***Introduction*** introduces main features and specifications
Chapter 2	***DM6956HR Board Settings*** provides information on factory-default and user-configurable jumper settings
Chapter 3	***Installing the dataModule*** provides information on installing the DM6956HR
Chapter 4	***Programming the dataModule*** provides information on how to program your DM6956HR
Appendix A	***IDAN™ Dimensions and Pinouts*** provides connector pinouts for the DM6956HR installed in an RTD Intelligent Data Acquisition Node (IDAN™) frame
Appendix B	***Limited Warranty***

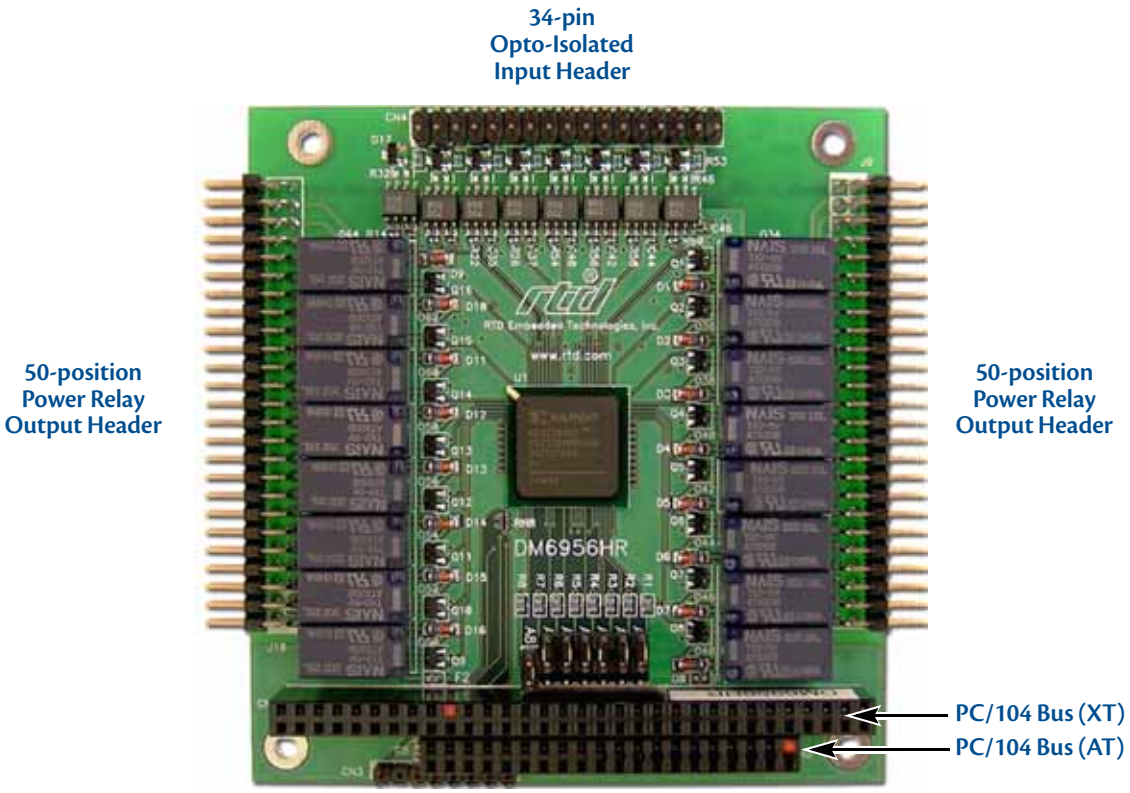


Figure 1 DM6956HR dataModule (Top View)

DM6956HR Ordering Information

The DM6956HR dataModule is available with both power relay output headers and screw terminal blocks. 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 Pinouts*, for more information. The DM6956HR 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.

DM6956HR Model Options

The DM6956HR model options are shown below. Refer to the RTD website (www.rtd.com) for more detailed ordering information.

Table 1 DM6956HR dataModule Options

Part Number	Description
DM6956HR-H	dataModule with 16 opto-isolated inputs and 16 power relay outputs: • one 34-pin input header • two 50-position output headers
DM6956HR-S	dataModule with 16 opto-isolated inputs and 16 power relay outputs: • one 34-pin input header • two 25-position output screw terminal blocks

Each DM6956HR package contains the following items:

- DM6956HR dataModule
- Companion CD containing software and documentation

DM6956HR Accessories

In addition to the items included in your DM6956HR 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, drivers, and hardware accessories to support your control system.

Table 2 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 DM6956HR dataModule include:

- Isolated inputs
  - 16 opto-isolated digital inputs
  - +5 V typical input range
    - On at +2.4 V, minimum
    - +15 V maximum input
  - Custom settings available
  - Reverse polarity protection
  - 1500 Vrms isolation
- Power relay outputs
  - 16 power relays with form C contacts
  - 60 VA switching capacity
  - Max switching current 2 A at 30 VDC
  - Max switching voltage 220 VDC/VAC
  - Operate and release time 4 ms
  - 1000 Vrms isolation
  - Expected life
    - Mechanical (at 180 cpm) 100,000,000 operations
    - Electrical at 2 A, 30 VDC resistive 100,000 operations
- Connectors
  - Opto-Isolated Inputs
    - Standard 34-pin 0.1-inch DIL header
  - Relay Outputs
    - –H: Standard 50-position 0.1-inch DIL headers
    - –S: Screw terminal blocks
- Physical and environmental
  - –40 to +85° C operating temperature
  - RTD IDAN™ compatible (see Appendix A, *IDAN™ Dimensions and Pinouts*)

Opto-Isolated Inputs

The DM6956HR has 16 opto-isolated inputs that provide a direct interface to digital signals requiring galvanic isolation or level shifting. Low-power 1000 V isolation optocouplers are used to implement the galvanically isolated inputs. A Schottky diode with +30 V reverse voltage protects the opto-isolated input diodes. These diodes can also be used to rectify an AC signal provided that the maximum input voltages are not exceeded. Each channel includes a current limiting resistor. This value is optimized for a +5 V nominal input range. A logical "1" is triggered at +2.4 V, minimum. The optocoupler will accept a voltage up to +15 V without destruction. A 34-pin flat ribbon cable can be used to connect the inputs to the dataModule.

Power Relay Outputs

The DM6956HR has 16 power relay outputs that may be used to directly drive loads that need high current such as solenoids, lamps, or motors. The 16 onboard miniature relays are designed to switch up to 2 A of 30 VDC current or 0.5 A of 115 VDC current. The relays' mechanical lifetime is reached at 100,000,000 operations, or 100,000 operations at full rated current contact life. A short action time of 4 ms for operate and release ensures reliable high speed switching. Each relay has a double pole, double throw contact arrangement with two sets of three contacts, which are normally open (NO), common (C), and normally closed (NC). The contacts are wired in parallel and brought to the I/O connector as a single set. Figure 4-1 below illustrates the connection of the relays used on your DM6956HR. Refer to *External I/O Connections* on page 13 when making connections.

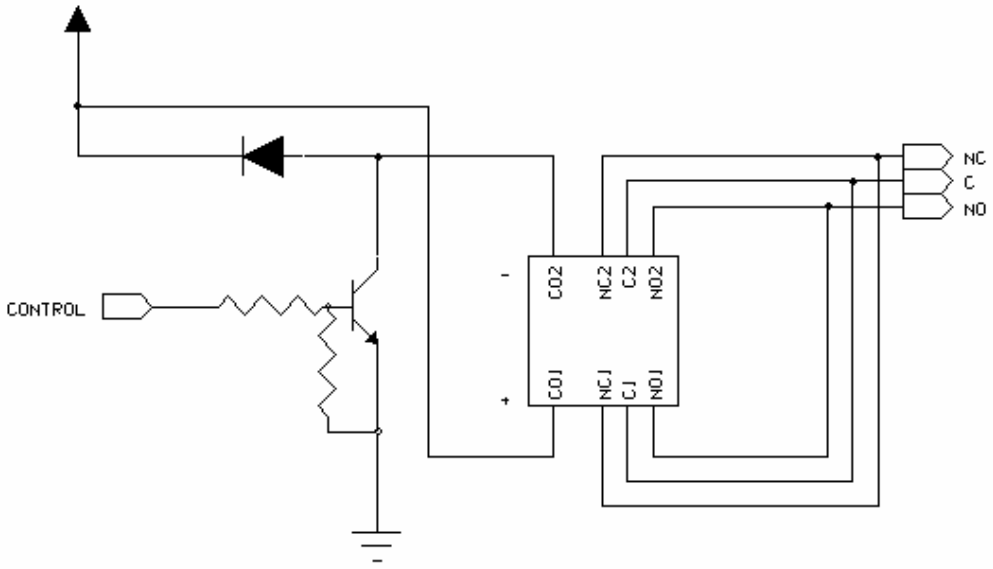


Figure 2 Power Relay Output Connection

Resets

The first reset occurs at power-up. The state of the relay outputs does not change even though a system software or hardware reset (WDT) may occur. Only a software-write to the output register will update the state of the relay outputs.

Mechanical Description

The DM6952HR 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 grouped together into one 34-pin header connector located at the top of the module. Power relay outputs are split into two 50-pin headers containing 8 channels each. The NC, NO and C relay terminals are available for all channels in these connectors. Figure 3 shows a simplified block diagram of the DM6956HR dataModule.

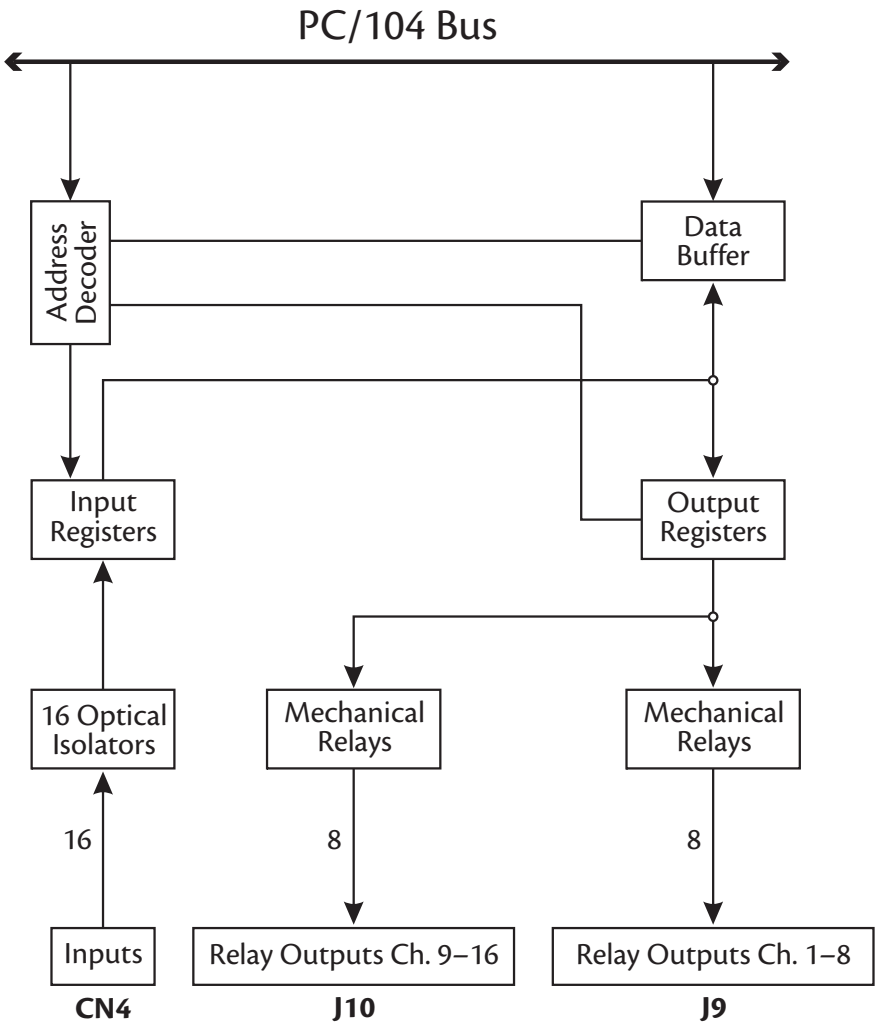


Figure 3 DM6956HR dataModule Simplified Block Diagram

Specifications

Host Interface

- Jumper selectable base address, I/O mapped

Power Relay Outputs

• Number of lines	16 relays
• Breakdown voltage	1000 Vrms
• Max switching power	60 W (resistive load) 30 W (motor load)
• Max switching voltage	220 VDC or VAC
• Max switching current	2 A
• Nominal switching capacity	2 A @ 30 VDC or 0.5 A @ 115 VAC
• Contact resistance	100 mΩ, maximum

Opto-Isolated Inputs

• Number of lines	16
• Isolation voltage (computer to I/O devices)	1000 Vrms
• Channel-to-channel isolation	350 Vrms
• Minimum on voltage	2.4 VDC
• Maximum input voltage	15 VDC

Connectors

• Input	one 34-pin header
• Outputs	two 50-pin headers
• Bus connectors	PC/104 XT and PC/104 AT

Power Requirements

• Supply voltage	+5V ± 8%
• Power consumption	1.4 W

Operating Temperature Range

• Standard	–40 to +85° C

For More Information

Contact RTD if you need further assistance.

RTD Embedded Technologies, Inc.
103 Innovation Blvd.
State College, PA 16803-0906
USA

Phone: +1-814-234-8087
Fax: +1-814-234-5218

E-mail: techsupport@rtd.com
sales@rtd.com

Internet: http://www.rtd.com

Chapter 2 DM6956HR Board Settings

The jumper settings of the DM6956HR opto-isolated input/power relay output dataModule can be changed to suit your application. This chapter provides the DM6956HR factory default and base address jumper settings.

Factory-Configured Jumper Settings

Figure 4 shows the dataModule layout and jumper locations. Table 3 provides the factory jumper settings for the DM6956HR. The following paragraphs explain how to change the factory jumper settings.

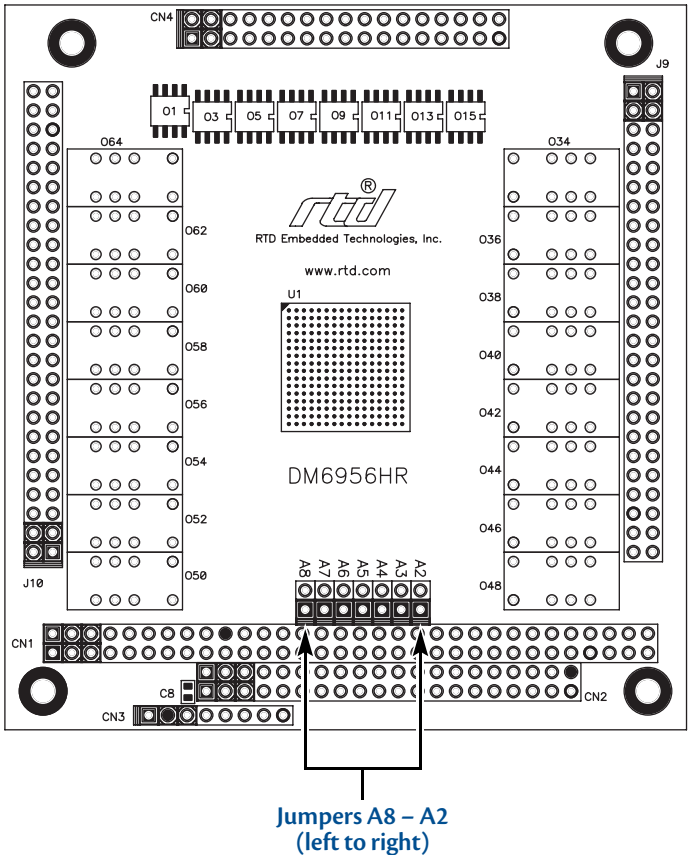


Figure 4 DM6956HR Jumper Locations

Table 3 Factory Jumper Settings

Jumper Name	Jumper Description	Number of Jumpers	Factory Setting Jumpers Installed
Base address	Base address	7	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 seven jumpers (**A2** through **A8**) marked **BASE**. This allows you to choose from 128 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 4, 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 DM6956HR inside the back cover of this manual.

Note *In Table 4, 1 = jumper installed, corresponding to a logical "1", and 0 = not jumpered, corresponding to a logical "1". The factory default base address is shaded.*

Table 4 DM6956HR dataModule Base Address Jumper Settings

Base Address Hex/(Decimal)	Jumper Settings 8 7 6 5 4 3 2	Base Address Hex/(Decimal)	Jumper Settings 8 7 6 5 4 3 2
200/(512)	0 0 0 0 0 0 0	300/(768)	1 0 0 0 0 0 0
210/(528)	0 0 0 0 1 0 0	310/(784)	1 0 0 0 1 0 0
220/(544)	0 0 0 1 0 0 0	320/(800)	1 0 0 1 0 0 0
230/(560)	0 0 0 1 1 0 0	330/(816)	1 0 0 1 1 0 0
240/(576)	0 0 1 0 0 0 0	340/(832)	1 0 1 0 0 0 0
250/(592)	0 0 1 0 1 0 0	350/(848)	1 0 1 0 1 0 0
260/(608)	0 0 1 1 0 0 0	360/(864)	1 0 1 1 0 0 0
270/(624)	0 0 1 1 1 0 0	370/(880)	1 0 1 1 1 0 0
280/(640)	0 1 0 0 0 0 0	380/(896)	1 1 0 0 0 0 0
290/(656)	0 1 0 0 1 0 0	390/(912)	1 1 0 0 1 0 0
2A0/(672)	0 1 0 1 0 0 0	3A0/(928)	1 1 0 1 0 0 0
2B0/(688)	0 1 0 1 1 0 0	3B0/(944)	1 1 0 1 1 0 0
2C0/(704)	0 1 1 0 0 0 0	3C0/(960)	1 1 1 0 0 0 0
2D0/(720)	0 1 1 0 1 0 0	3D0/(976)	1 1 1 0 1 0 0
2E0/(736)	0 1 1 1 0 0 0	3E0/(922)	1 1 1 1 0 0 0
2F0/(752)	0 1 1 1 1 0 0	3F0/(1008)	1 1 1 1 1 0 0

Note *Not all possible address combinations are shown.*

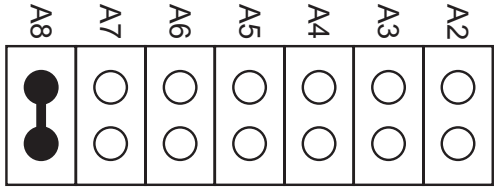


Figure 5 Base Address Jumpers Set for 300h

Chapter 3 Installing the dataModule

The DM6956HR opto-isolated input/power relay output dataModule interfaces easily to PC/104 systems, such as industrial or automotive control systems. This chapter provides general installation guidelines for the DM6956HR dataModule.

After completing the installation, RTD recommends using the diagnostic software included in your DM6956HR package to fully verify that your module is working.

DM6956HR Connectors

Figure 6 shows the connectors of the DM6956HR dataModule.

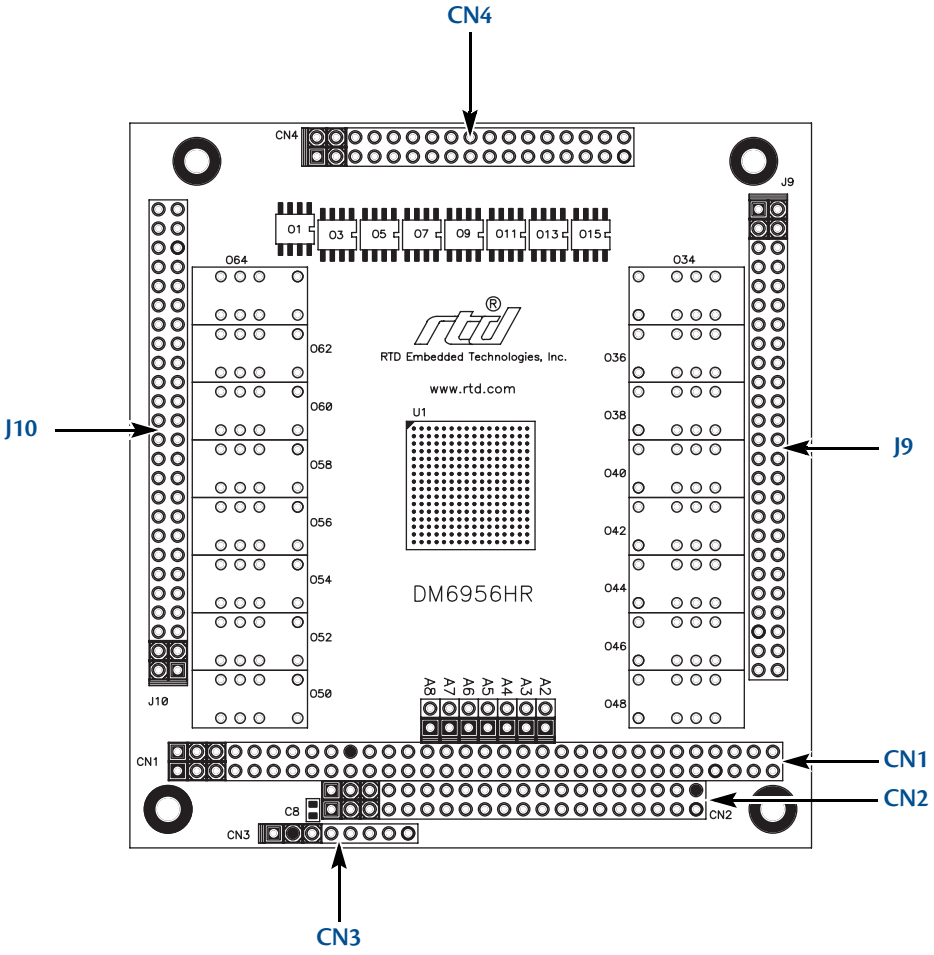


Figure 6 DM6956HR Connector Locations

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 5 DM6956HR Connectors

Connector	Function	Size
CN1	PC/104 Bus (XT)	64-pin
CN2	PC/104 Bus (AT)	40-pin
CN3	Factory use only	8-pin
CN4	Input Connector	34-pin
J10	Left Output Connector	50-pin
J9	Right Output Connector	50-pin

External I/O Connections

Table 6 below shows the input connector pinout. With the dataModule 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 DM6956HR can be connected to an input device using a twisted pair, 34-pin flat cable or discrete wires.

Table 6 Input Connector Pinout (CN4)

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–
Not used	33	34	Not used

Table 7 shows the output connection pinouts of both **J10** (left output connector) and **J9** (right output connector), with the dataModule oriented with the PC/104 (ISA) bus in the 6 o' clock position (toward the bottom). The DM6956HR can be connected to output devices using twisted pair, 50-pin flat cables (DM6956HR-H), screw terminal boards (DM6956HR-S), 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.* ***J10****, Pin1, is oriented near the ISA bus.* ***J9****, Pin 1, is away from the ISA bus.*

Table 7 Output Connector Pinouts (J10 and J9)

J10 (Left Output Connector)					
Relay/Term		Pin	Pin	Relay/Term	
9	NO	1	2	9	NO
9	C	3	4	9	C
9	NC	5	6	9	NC
10	NO	7	8	10	NO
10	C	9	10	10	C
10	NC	11	12	10	NC
11	NO	13	14	11	NO
11	C	15	16	11	C
11	NC	17	18	11	NC
12	NO	19	20	12	NO
12	C	21	22	12	C
12	NC	23	24	12	NC
13	NO	25	26	13	NO
13	C	27	28	13	C
13	NC	29	30	13	NC
14	NO	31	32	14	NO
14	C	33	34	14	C
14	NC	35	36	14	NC
15	NO	37	38	15	NO
15	C	39	40	15	C
15	NC	41	42	15	NC
16	NO	43	44	16	NO
16	C	45	46	16	C
16	NC	47	48	16	NC
Not used		49	50	Not used	

J9 (Right Output Connector)					
Relay/Term		Pin	Pin	Relay/Term	
1	NO	1	2	1	NO
1	C	3	4	1	C
1	NC	5	6	1	NC
2	NO	7	8	2	NO
2	C	9	10	2	C
2	NC	11	12	2	NC
3	NO	13	14	3	NO
3	C	15	16	3	C
3	NC	17	18	3	NC
4	NO	19	20	4	NO
4	C	21	22	4	C
4	NC	23	24	4	NC
5	NO	25	26	5	NO
5	C	27	28	5	C
5	NC	29	30	5	NC
6	NO	31	32	6	NO
6	C	33	34	6	C
6	NC	35	36	6	NC
7	NO	37	38	7	NO
7	C	39	40	7	C
7	NC	41	42	7	NC
8	NO	43	44	8	NO
8	C	45	46	8	C
8	NC	47	48	8	NC
Not used		49	50	Not used	

Table 8 Output Connector Signals

Signal	Definition
NO	**Normally Open Contact**. When power is off or a 0 bit is written to the relay control register, this contact is **NOT** connected. When power is on and a 1 bit is written to the relay control register, this signal is connected to the C (common) contact.
C	**Relay Common Contact**. This contact is always used with relay output connections.
NC	**Normally Closed Contact**. When power is off or a 0 bit is written to the relay control register, this contact **IS** connected to the C (common) contact. When power is on and a 1 bit is written to the relay control register, this contact is not connected.

Installation Considerations

Consider the following points before integrating the DM6956HR dataModule into a PC/104 stack.

1. The DM6956HR is a PC/104 module with an ISA bus (PC XT and AT connectors) and no PCI bus. Therefore, the DM6956HR 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 DM6956HR 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 DM6956HR 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 DM6956HR in your computer, check the jumper settings. Refer to Chapter 2 for factory-default jumper settings and how to change them.

Installing the DM6956HR 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, *DM6956HR Board Settings*.

CAUTION *The DM6956HR 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 DM6956HR'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 DM6956HR, 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 DM6956HR dataModule. It provides a complete description of the I/O map, plus a detailed discussion of programming operations.

Defining the I/O Map

Table 9 provides the I/O map of the DM6956HR. As shown, the module occupies four addresses. The Base Address (designated as BA) can be set using the jumpers as described in Chapter 2, *DM6956HR Board Settings*. The following sections describe the register contents of each address used in the I/O map.

Table 9 DM6956HR I/O Map[1]

Write	Read	Address (hex)
Relay Outputs 1–8	Relay Outputs 1–8	BA + 0h
Relay Outputs 9–16	Relay Outputs 9–16	BA + 1h
N/A	Inputs 1–8	BA + 2h
N/A	Inputs 9–16	BA + 3h
N/A	Read RTD ID Data	BA + 400h
N/A	Read RTD ID Data	BA + 401h
N/A	Read RTD ID Reset Pointer	BA + 402h

1. BA = Base Address.

BA + 0 Digital Outputs (write/read, 8-bit or 16-bit)

This data output register controls the output relays 1–8 (1–16 for 16-bit). Data is transferred from the data register to the outputs by performing an 8-bit write to **BA + 0**. Direct transfer of data to the output latches for all the 16 relays can be performed by executing a 16-bit write to **BA + 0**. The last data written to the relays can be read by reading **BA + 0**.

BA + 1 Digital Outputs (write/read, 8-bit only)

This data output register controls the output relays 9–16. Data is transferred from the data register to the outputs by performing an 8-bit write to **BA + 1**. The last data written to the relays can be read by reading **BA + 1**.

Note *Writing a 0 bit switches the output relay to normally closed (NC). Writing a 1 bit switches the output relay to normally open (NO).*

BA + 2 Digital Inputs (read only, 8-bit or 16-bit)

This data input register returns the data from isolated input channels 1–8 (1–16 for 16-bit). Data is transferred from the input register by performing an 8-bit read to **BA + 2**. Direct transfer of data from all 16 inputs can be executed with a 16-bit read to **BA + 2**. Writes to this address have no effect.

BA + 3 Digital Inputs (read only, 8-bit only)

This data input register returns the data from isolated input channels 9–16. Data is transferred from the input register by performing an 8-bit read to **BA + 3**. Writes to this address have no effect.

BA + 400h/BA + 401h 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 10. The pointer is set to zero at reset and can be reset to zero by a read to **BA + 402h**.

Table 10 RTD ID Data Read Indexes

Index	Data	8-Bit Read	16-Bit Read
0	Device ID	56h	6956h
1	Device ID	69h	—
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	69
13	Board Name String	9	—
14	Board Name String	5	56
15	Board Name String	6	—
16	Board Name String	<nul>	<nul><nul>
17	Board Name String	<nul>	—
18–255	Unused	FFh	FFFFh

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

A read to **BA + 402h** will set the internal pointer to zero. The pointer is set to zero at reset.

Controlling the DM6956HR via Software

RTD Provided Software

The companion CD that shipped with your DM6956HR 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 DM6956HR. The example programs demonstrate the DM6956HR'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 DM6956HR. However, if you are using an unsupported operating system, you may need to access the DM6956HR'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 DM6956HR on behalf of your application.*

Usually, manipulating the registers of the DM6956HR 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 logical 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 logical 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 logical 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 DM6956HR. If your software manipulates a reserved bit, it may not be compatible with future board revisions.*

Appendix A IDAN™ Dimensions and Pinouts

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 DM6956HR 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 DM6956HR 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-DM6956HR-62D

The IDAN-DM6956HR-62D is a DM6956HR dataModule packaged in an IDAN frame with two 62-pin D subminiature, front panel, power relay output connectors (female) and one 37-pin D subminiature, rear panel, opto-isolated input connector (female).

IDAN-DM6956HR-62D Dimensions and Connectors

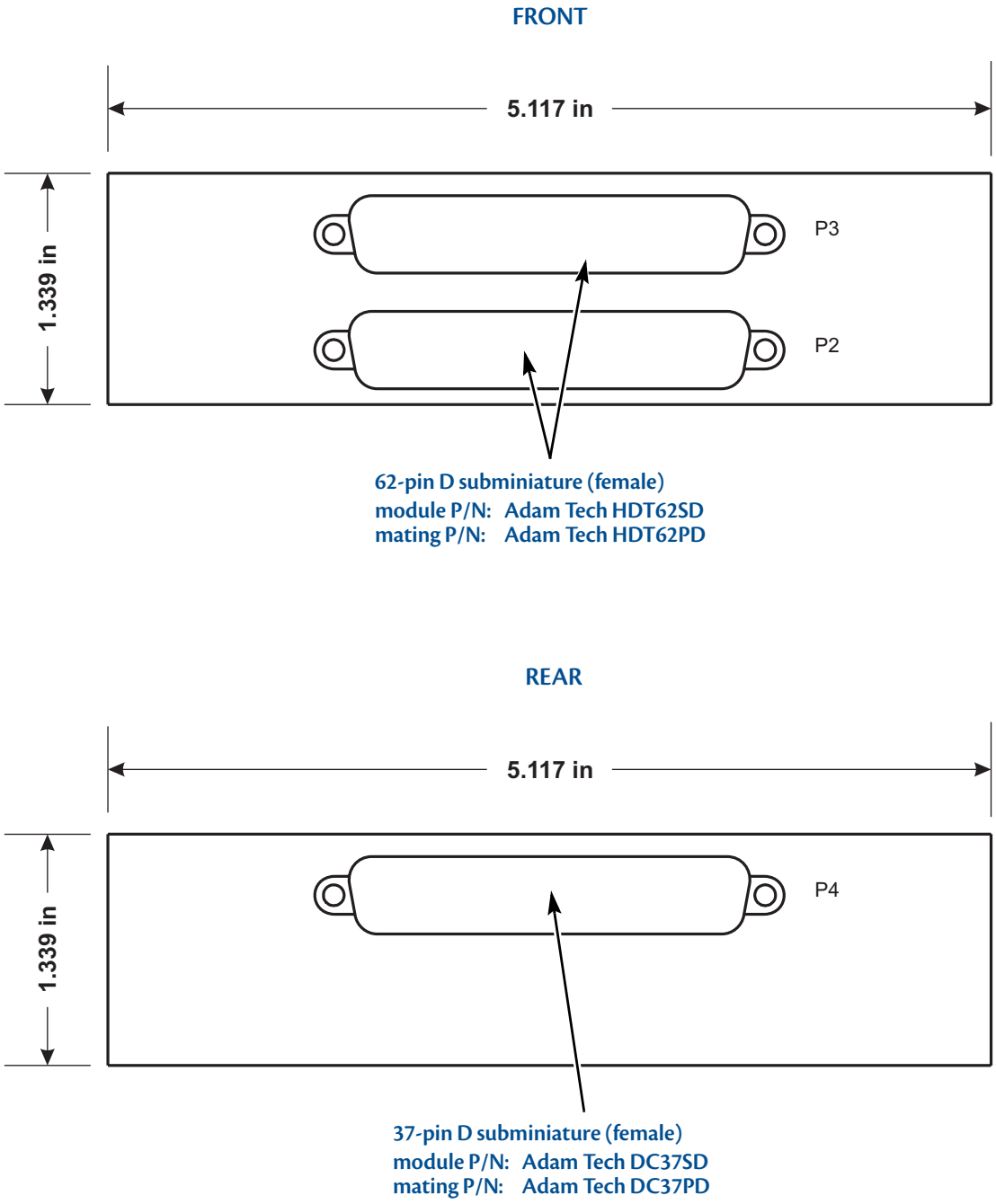
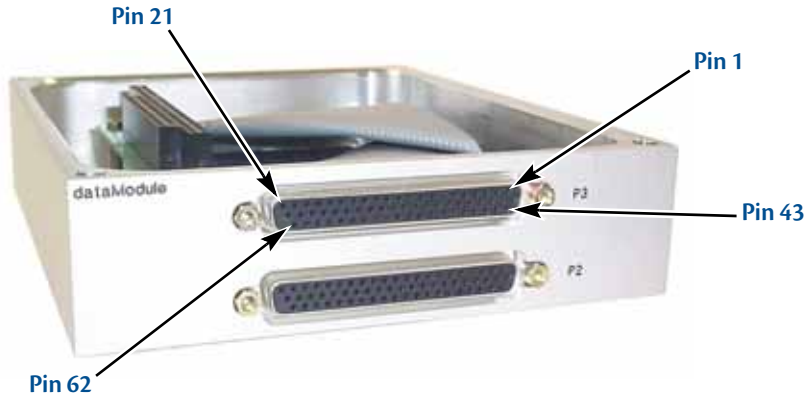


Figure 7 IDAN-DM6956HR-62D Connectors

FRONT



REAR

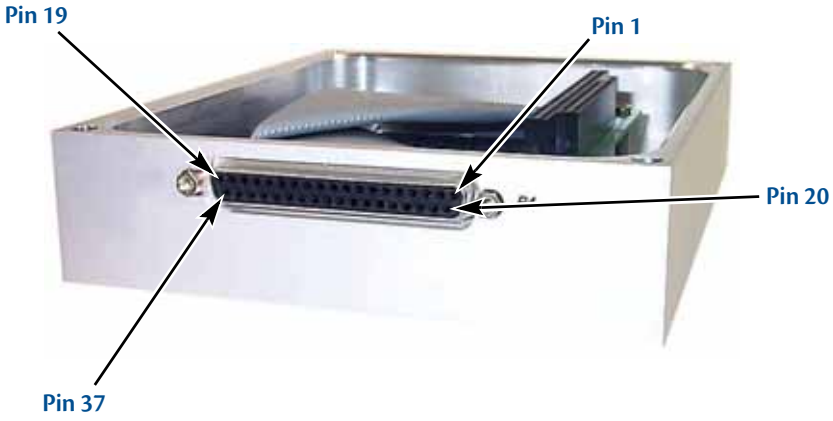


Figure 8 IDAN-DM6956HR-62D Connector Pins

CAUTION *Do not make connections to reserved pins!*

Note *Photographs are not to scale.*

IDAN-DM6956HR-62D External I/O Connections

Table 11 IDAN-DM6956-62D Front Panel Connectors

IDAN P2 Pin #			Signal	DM6956 J9 Pin #	IDAN P3 Pin #			Signal	DM6956 J10 Pin #
Row 1	Row 2	Row 3			Row 1	Row 2	Row 3		
1	—	—	Relay 1 (NO)	1	1	—	—	Relay 9 (NO)	1
—	22	—	Relay 1 (NO)	2	—	22	—	Relay 9 (NO)	2
—	—	43	Relay 1 (C)	3	—	—	43	Relay 9 (C)	3
2	—	—	Relay 1 (C)	4	2	—	—	Relay 9 (C)	4
—	23	—	Relay 1 (NC)	5	—	23	—	Relay 9 (NC)	5
—	—	44	Relay 1 (NC)	6	—	—	44	Relay 9 (NC)	6
3	—	—	Relay 2 (NO)	7	3	—	—	Relay 10 (NO)	7
—	24	—	Relay 2 (NO)	8	—	24	—	Relay 10 (NO)	8
—	—	45	Relay 2 (C)	9	—	—	45	Relay 10 (C)	9
4	—	—	Relay 2 (C)	10	4	—	—	Relay 10 (C)	10
—	25	—	Relay 2 (NC)	11	—	25	—	Relay 10 (NC)	11
—	—	46	Relay 2 (NC)	12	—	—	46	Relay 10 (NC)	12
5	—	—	Relay 3 (NO)	13	5	—	—	Relay 11 (NO)	13
—	26	—	Relay 3 (NO)	14	—	26	—	Relay 11 (NO)	14
—	—	47	Relay 3 (C)	15	—	—	47	Relay 11 (C)	15
6	—	—	Relay 3 (C)	16	6	—	—	Relay 11 (C)	16
—	27	—	Relay 3 (NC)	17	—	27	—	Relay 11 (NC)	17
—	—	48	Relay 3 (NC)	18	—	—	48	Relay 11 (NC)	18
7	—	—	Relay 4 (NO)	19	7	—	—	Relay 12 (NO)	19
—	28	—	Relay 4 (NO)	20	—	28	—	Relay 12 (NO)	20
—	—	49	Relay 4 (C)	21	—	—	49	Relay 12 (C)	21
8	—	—	Relay 4 (C)	22	8	—	—	Relay 12 (C)	22
—	29	—	Relay 4 (NC)	23	—	29	—	Relay 12 (NC)	23
—	—	50	Relay 4 (NC)	24	—	—	50	Relay 12 (NC)	24
9	—	—	Relay 5 (NO)	25	9	—	—	Relay 13 (NO)	25
—	30	—	Relay 5 (NO)	26	—	30	—	Relay 13 (NO)	26
—	—	51	Relay 5 (C)	27	—	—	51	Relay 13 (C)	27
10	—	—	Relay 5 (C)	28	10	—	—	Relay 13 (C)	28
—	31	—	Relay 5 (NC)	29	—	31	—	Relay 13 (NC)	29
—	—	52	Relay 5 (NC)	30	—	—	52	Relay 13 (NC)	30
11	—	—	Relay 6 (NO)	31	11	—	—	Relay 14 (NO)	31
—	32	—	Relay 6 (NO)	32	—	32	—	Relay 14 (NO)	32
—	—	53	Relay 6 (C)	33	—	—	53	Relay 14 (C)	33
12	—	—	Relay 6 (C)	34	12	—	—	Relay 14 (C)	34
—	33	—	Relay 6 (NC)	35	—	33	—	Relay 14 (NC)	35
—	—	54	Relay 6 (NC)	36	—	—	54	Relay 14 (NC)	36
13	—	—	Relay 7 (NO)	37	13	—	—	Relay 15 (NO)	37
—	34	—	Relay 7 (NO)	38	—	34	—	Relay 15 (NO)	38
—	—	55	Relay 7 (C)	39	—	—	55	Relay 15 (C)	39
14	—	—	Relay 7 (C)	40	14	—	—	Relay 15 (C)	40
—	35	—	Relay 7 (NC)	41	—	35	—	Relay 15 (NC)	41
—	—	56	Relay 7 (NC)	42	—	—	56	Relay 15 (NC)	42
15	—	—	Relay 8 (NO)	43	15	—	—	Relay 16 (NO)	43
—	36	—	Relay 8 (NO)	44	—	36	—	Relay 16 (NO)	44
—	—	57	Relay 8 (C)	45	—	—	57	Relay 16 (C)	45
16	—	—	Relay 8 (C)	46	16	—	—	Relay 16 (C)	46
—	37	—	Relay 8 (NC)	47	—	37	—	Relay 16 (NC)	47
—	—	58	Relay 8 (NC)	48	—	—	58	Relay 16 (NC)	48
17	—	—	Reserved	49	17	—	—	Reserved	49
—	38	—	Reserved	50	—	38	—	Reserved	50

Table 12 IDAN-DM6956-62D Rear Panel Connector

IDAN P4 Pin #		Signal	DM6956 CN4 Pin #
Row 1	Row 2		
1	—	+IN1	1
—	20	–IN1	2
2	—	+IN2	3
—	21	–IN2	4
3	—	+IN3	5
—	22	–IN3	6
4	—	+IN4	7
—	23	–IN4	8
5	—	+IN5	9
—	24	–IN5	10
6	—	+IN6	11
—	25	–IN6	12
7	—	+IN7	13
—	26	–IN7	14
8	—	+IN8	15
—	27	–N8	16
9	—	+IN9	17
—	28	–IN9	18
10	—	+IN10	19
—	29	–IN10	20
11	—	+IN11	21
—	30	–IN11	22
12	—	+IN12	23
—	31	–IN12	24
13	—	+IN13	25
—	32	–IN13	26
14	—	+IN14	27
—	33	–IN14	28
15	—	+IN15	29
—	34	–IN15	30
16	—	+IN16	31
—	35	–IN16	32
17	—	Reserved	33
—	36	Reserved	34
18	—	Reserved	—
—	37	Reserved	—
19	—	Reserved	—

IDAN-DM6956HR-68D

The IDAN-DM6956HR-68D is a DM6956HR dataModule packaged in an IDAN frame with two 68-pin high density D front panel, power relay output connectors (female) and one 37-pin D subminiature, rear panel, opto-isolated input connector (female).

IDAN-DM6956HR-68D Dimensions and Connectors

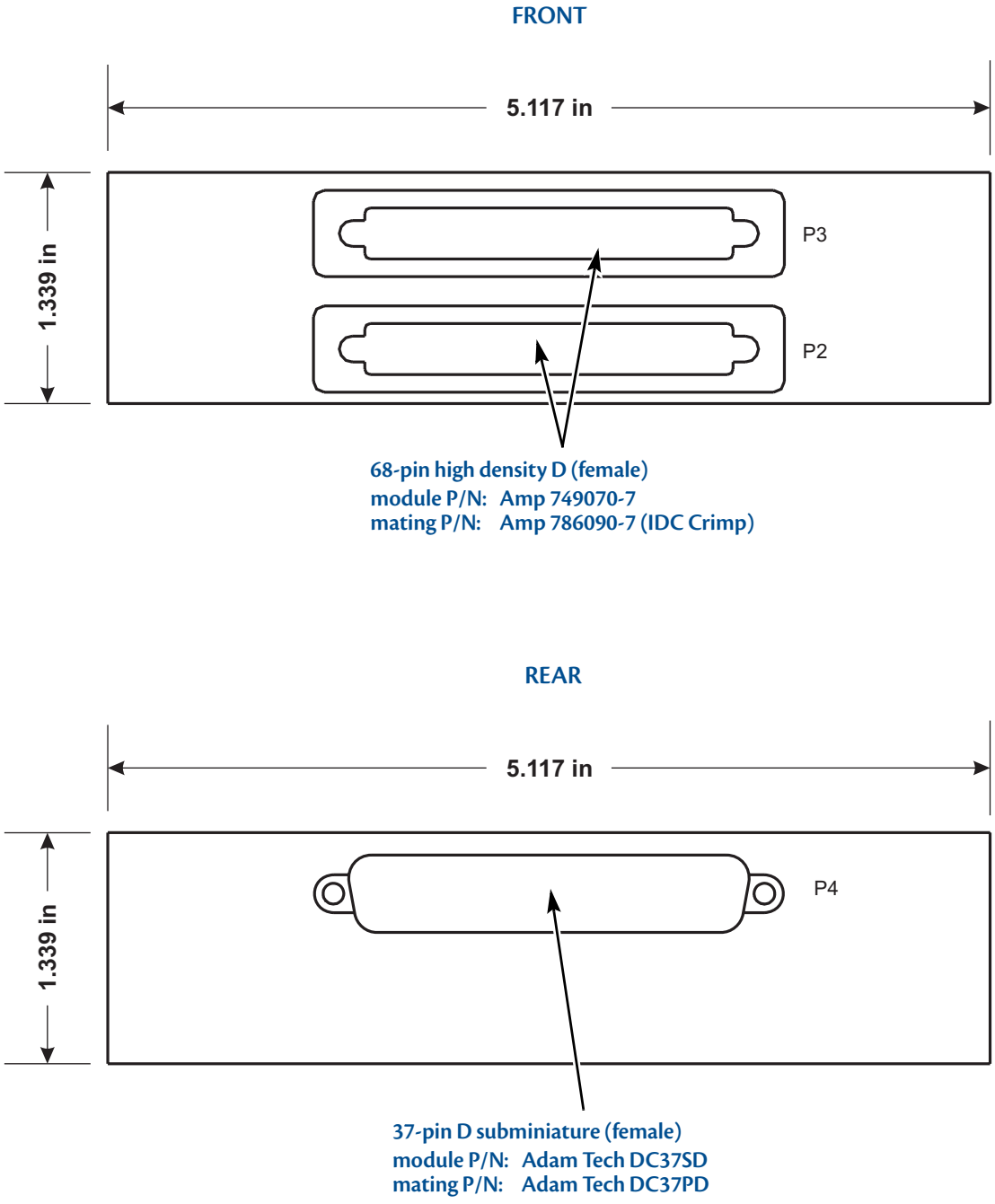
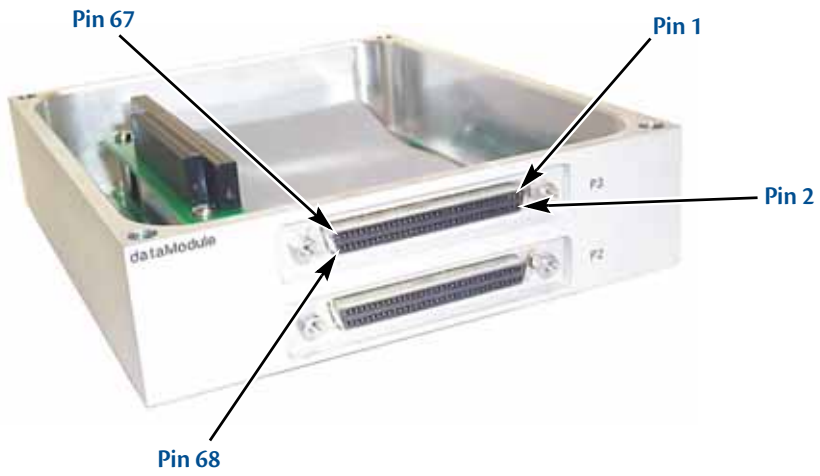


Figure 9 IDAN-DM6956HR-68D Connectors

FRONT



REAR

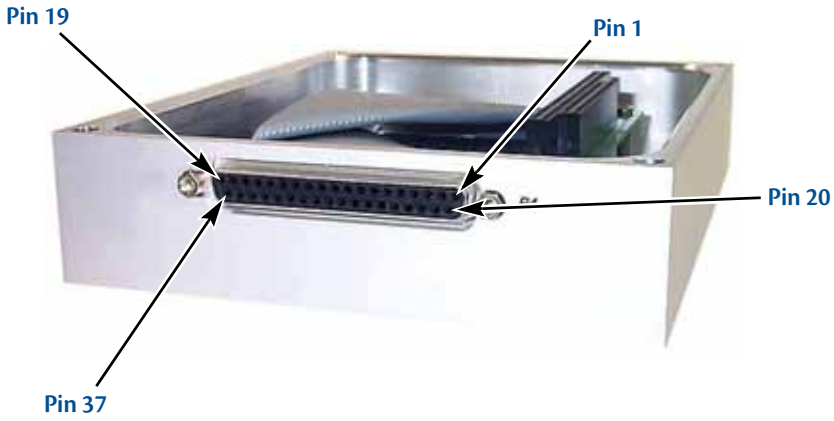


Figure 10 IDAN-DM6956HR-68D Connector Pins

CAUTION *Do not make connections to reserved pins!*

Note *Photographs are not to scale.*

IDAN-DM6956HR-68D External I/O Connections

Table 13 IDAN-DM6956-68D Front Panel Connectors

IDAN P2 Pin #		Signal	DM6956 J9 Pin #	IDAN P3 Pin #		Signal	DM6956 J10 Pin #
Row 1	Row 2			Row 1	Row 2		
1	—	Relay 1 (NO)	1	1	—	Relay 9 (NO)	1
—	2	Relay 1 (NO)	2	—	2	Relay 9 (NO)	2
3	—	Relay 1 (C)	3	3	—	Relay 9 (C)	3
—	4	Relay 1 (C)	4	—	4	Relay 9 (C)	4
5	—	Relay 1 (NC)	5	5	—	Relay 9 (NC)	5
—	6	Relay 1 (NC)	6	—	6	Relay 9 (NC)	6
7	—	Relay 2 (NO)	7	7	—	Relay 10 (NO)	7
—	8	Relay 2 (NO)	8	—	8	Relay 10 (NO)	8
9	—	Relay 2 (C)	9	9	—	Relay 10 (C)	9
—	10	Relay 2 (C)	10	—	10	Relay 10 (C)	10
11	—	Relay 2 (NC)	11	11	—	Relay 10 (NC)	11
—	12	Relay 2 (NC)	12	—	12	Relay 10 (NC)	12
13	—	Relay 3 (NO)	13	13	—	Relay 11 (NO)	13
—	14	Relay 3 (NO)	14	—	14	Relay 11 (NO)	14
15	—	Relay 3 (C)	15	15	—	Relay 11 (C)	15
—	16	Relay 3 (C)	16	—	16	Relay 11 (C)	16
17	—	Relay 3 (NC)	17	17	—	Relay 11 (NC)	17
—	18	Relay 3 (NC)	18	—	18	Relay 11 (NC)	18
19	—	Relay 4 (NO)	19	19	—	Relay 12 (NO)	19
—	20	Relay 4 (NO)	20	—	20	Relay 12 (NO)	20
21	—	Relay 4 (C)	21	21	—	Relay 12 (C)	21
—	22	Relay 4 (C)	22	—	22	Relay 12 (C)	22
23	—	Relay 4 (NC)	23	23	—	Relay 12 (NC)	23
—	24	Relay 4 (NC)	24	—	24	Relay 12 (NC)	24
25	—	Relay 5 (NO)	25	25	—	Relay 13 (NO)	25
—	26	Relay 5 (NO)	26	—	26	Relay 13 (NO)	26
27	—	Relay 5 (C)	27	27	—	Relay 13 (C)	27
—	28	Relay 5 (C)	28	—	28	Relay 13 (C)	28
29	—	Relay 5 (NC)	29	29	—	Relay 13 (NC)	29
—	30	Relay 5 (NC)	30	—	30	Relay 13 (NC)	30
31	—	Relay 6 (NO)	31	31	—	Relay 14 (NO)	31
—	32	Relay 6 (NO)	32	—	32	Relay 14 (NO)	32
33	—	Relay 6 (C)	33	33	—	Relay 14 (C)	33
—	34	Relay 6 (C)	34	—	34	Relay 14 (C)	34
35	—	Relay 6 (NC)	35	35	—	Relay 14 (NC)	35
—	36	Relay 6 (NC)	36	—	36	Relay 14 (NC)	36
37	—	Relay 7 (NO)	37	37	—	Relay 15 (NO)	37
—	38	Relay 7 (NO)	38	—	38	Relay 15 (NO)	38
39	—	Relay 7 (C)	39	39	—	Relay 15 (C)	39
—	40	Relay 7 (C)	40	—	40	Relay 15 (C)	40
41	—	Relay 7 (NC)	41	41	—	Relay 15 (NC)	41
—	42	Relay 7 (NC)	42	—	42	Relay 15 (NC)	42
43	—	Relay 8 (NO)	43	43	—	Relay 16 (NO)	43
—	44	Relay 8 (NO)	44	—	44	Relay 16 (NO)	44
45	—	Relay 8 (C)	45	45	—	Relay 16 (C)	45
—	46	Relay 8 (C)	46	—	46	Relay 16 (C)	46
47	—	Relay 8 (NC)	47	47	—	Relay 16 (NC)	47
—	48	Relay 8 (NC)	48	—	48	Relay 16 (NC)	48
49	—	Reserved	49	49	—	Reserved	49
—	50	Reserved	50	—	50	Reserved	50

Table 14 IDAN-DM6956-68D Rear Panel Connector

IDAN P4 Pin #		Signal	DM6956 CN4 Pin #
Row 1	Row 2		
1	—	+IN1	1
—	20	–IN1	2
2	—	+IN2	3
—	21	–IN2	4
3	—	+IN3	5
—	22	–IN3	6
4	—	+IN4	7
—	23	–IN4	8
5	—	+IN5	9
—	24	–IN5	10
6	—	+IN6	11
—	25	–IN6	12
7	—	+IN7	13
—	26	–IN7	14
8	—	+IN8	15
—	27	–N8	16
9	—	+IN9	17
—	28	–IN9	18
10	—	+IN10	19
—	29	–IN10	20
11	—	+IN11	21
—	30	–IN11	22
12	—	+IN12	23
—	31	–IN12	24
13	—	+IN13	25
—	32	–IN13	26
14	—	+IN14	27
—	33	–IN14	28
15	—	+IN15	29
—	34	–IN15	30
16	—	+IN16	31
—	35	–IN16	32
17	—	Reserved	33
—	36	Reserved	34
18	—	Reserved	—
—	37	Reserved	—
19	—	Reserved	—

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.

RTD Embedded Technologies, Inc.
103 Innovation Blvd.
State College PA 16803-0906
USA
Website: www.rtd.com