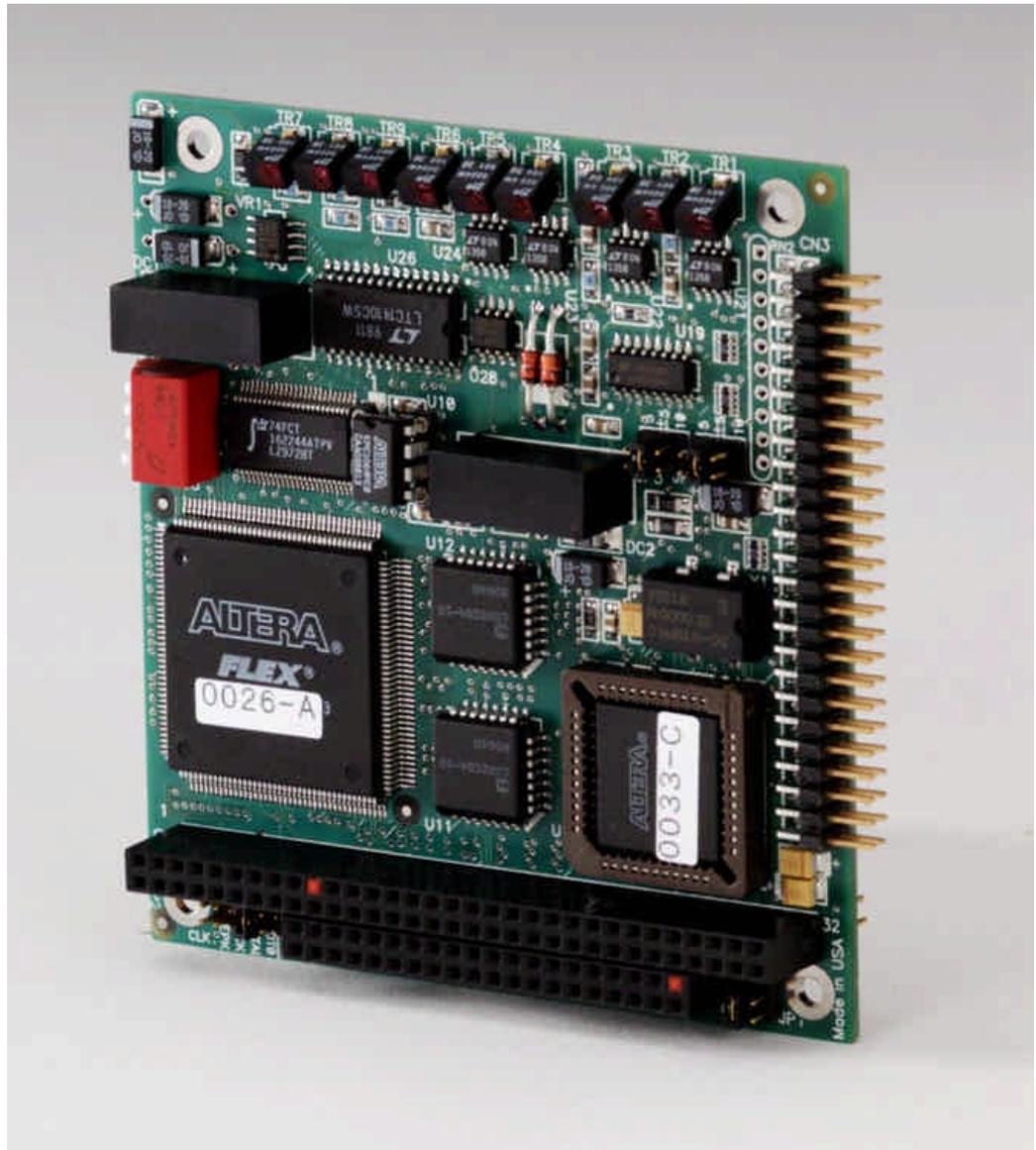


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Technical Manual

# *SMART TRAC™ DM6420 Multi I/O Card*





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# Important Safety and Warranty Information

## Warnings, Cautions and Notes



### WARNING

A statement of conditions which **MUST BE OBSERVED** to prevent personal injury or death.



### WARNING - ESD

A statement of conditions which must be observed to prevent damage to components due to ESD (ElectroStatic Discharge) and to prevent personal injury or death.



### CAUTION

A statement of conditions which must be observed to prevent undesired equipment faults, Smart Trac AC1 system degradation and damage to equipment.

### IMPORTANT

A statement of conditions which should be observed during Smart Trac AC DeviceNet setup or operation to ensure dependable service.

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**NOTE:** Notes indicate information that is in addition to a discussion of the topic in adjoining text. Alternatively, it may limit or restrict the paragraph(s) that follow(s) to specific models or conditions.

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**TIP -** Tips indicate information that should make a procedure easier or more efficient.

## General Safety Precautions - Warnings

Important safety information follows. Please *read and understand* all precautions listed below before proceeding with the specification, installation, set-up or operation of your Smart Trac AC1. Failure to follow any of the following precautions may result in personal injury or death, or damage to the equipment.



### **WARNING - ESD**

The Control Printed Circuit Board (PCB) employs CMOS Integrated Circuits that are easily damaged by static electricity. Use proper ElectroStatic Discharge (ESD) procedures when handling the Control PCB. See Smart Trac AC1 Technical Manual for details. Failure to comply may result in damage to equipment and/or personal injury.

## Important Warranty Information.

Do not modify your Smart Trac AC1, its components, or any of the procedures contained in the technical documentation supplied by MagneTek. Any modification of this product by the user is not the responsibility of MagneTek and will void the warranty.

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# Smart Trac DM6420 Multi I/O Card

## General Capabilities

Adding the Smart Trac DM6420 Multi I/O Card to your Smart Trac AC1 card stack provides high performance data acquisition and control capabilities in addition to drive, PLC and networking functions. The card also conforms to PC/104 specifications.

## Specifications

- 8 differential or 16 single-ended analog input channels.
- 12-bit, 2 microsecond analog-to-digital converter with 500 kHz throughput
- Programmable input ranges:  $\pm 5$ ,  $\pm 10$  or 0 to +10 volts
- Programmable gains of 1, 2, 4 and 8
- 8 bit programmable digital I/O lines.
- 8 port (byte) programmable I/O lines
- Two 12-bit digital-to-analog output channels
- $\pm 5$ , 0 to +5 volt or 0 to +10 volt analog output range

## Quick Start

1. Check DIP switch settings on the card against the default settings (see "Default Settings"). You should use default settings except in only unusual situations. Your Smart Trac Field Engineer can help you if you need assistance.
2. Power OFF your Smart Trac AC1.
3. Install the card in your Smart Trac AC1 in a PC/104 option card position (on top of the Smart Trac Ethernet Card or another PC/104 option card).
4. Power up your Smart Trac AC1.
5. Test your card installation.

# Smart Trac DM6420 Multi I/O Basics

## Introduction

The Smart Trac DM6420 Multi I/O card supports up to sixteen software-selectable analog input channels, an A/D converter, two D/A converters and sixteen digital I/O points.

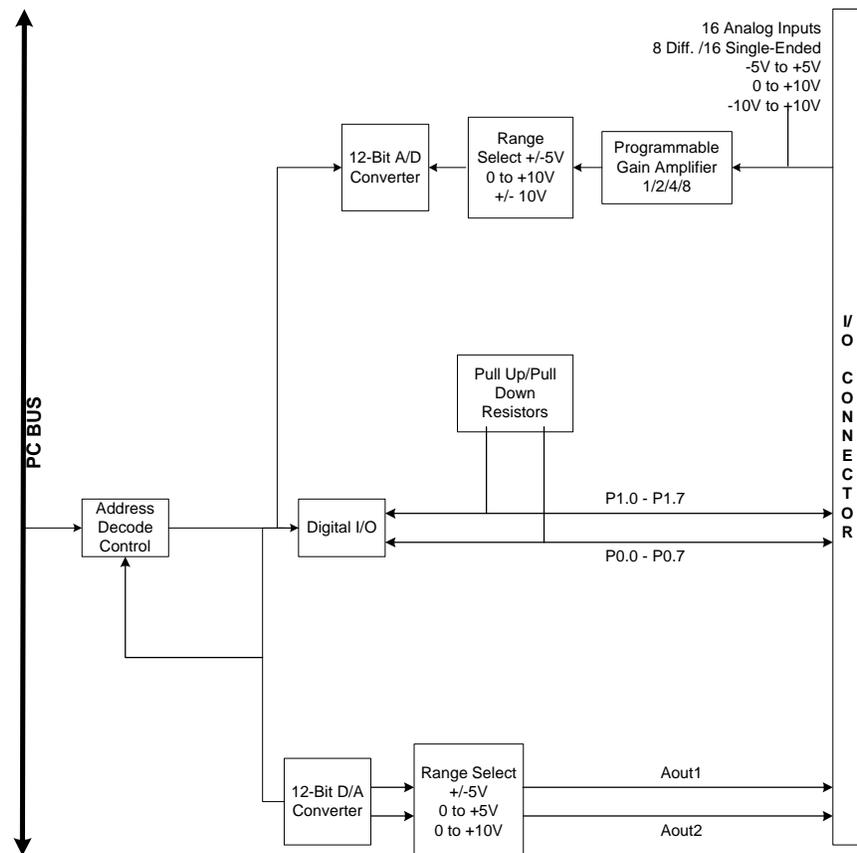


Figure 1. Functional Block Diagram of the Smart Trac DM6420 Multi I/O Card.

## Smart Trac DM6420 Multi I/O Card

### Analog Inputs

The card supports up to sixteen software-selectable analog input channels. You may program the input voltage range for -5 to +5 volts, -10 to +10 volts, or 0 to +10 volts.

Your Smart Trac DM6420 Multi I/O may be programmed with binary gains of 1, 2, 4, and 8, to amplify lower level signals to more closely match the module's input ranges (see Table 1). Overvoltage protection to  $\pm 12$  volts is provided at the inputs.

*Table 1. Input signal amplification for selected input ranges.*

Selected Input Range	Maximum Magnitude of Input Signal			
	Gain=1	Gain=2	Gain=3	Gain=4
$\pm 5V$	$\pm 5V$	$\pm 2.5V$	$\pm 1.25V$	$\pm 0.625V$
$\pm 10V$	$\pm 10V$	$\pm 5.0V$	$\pm 2.50V$	$\pm 1.25V$
0-10V	0-10V	0-5V	0-2.5V	0-1.25V

### A/D Converter

The 12-bit successive approximation A/D converter accurately digitizes dynamic input voltages in 2 micro-seconds, for a maximum throughput rate of 500 kHz. The converter IC contains a sample-and-hold amplifier, a 12-bit A/D converter, a 2.4-volt reference, a clock, and a digital interface to provide a complete A/D conversion function on a single chip. Conversions are controlled by Smart Trac software commands.

### D/A Converters

Two independent 12-bit analog output channels are included on the Smart Trac DM6420 Multi I/O Card. The analog outputs are generated by two 12-bit D/A converters with independent jumper-selectable output ranges of  $\pm 5$ , 0 to +5, or 0 to +10 volts. The 10-volt ranges have a resolution of 2.44 millivolts, and the 5-volt range has a resolution of 1.22 millivolts.

### Digital I/O

Data may be transferred between your Smart Trac DM6420 Multi I/O card and external devices using sixteen (16) digital I/O points. Eight of these points are bit programmable and eight are byte, or port, programmable.

- Port 0 provides eight bit programmable points which can be independently set for input or output.
- Port 1 can be programmed as an 8-bit input or output port.

---

# Installing the Smart Trac DM6420 Multi I/O Card

## Unpacking

### Electrostatic Discharge (ESD) Procedures



#### **WARNING - ESD**

Keep electronic circuit boards in Electrostatic Discharge (ESD) protective bags when not being handled. Use proper ESD procedures (including an ESD wrist strap) when handling circuit boards. Failure to comply may result in damage to equipment.

When working with an electrostatic discharge (ESD) sensitive device, you should be grounded at all times. The easiest and most common way to provide this ground is to use an approved ESD wrist strap. The strap is secured to your wrist with a wire attached to the strap and clipped or taped to the chassis of the unit being worked on. Any static is dissipated through the wire to ground, greatly reducing the possibility of damage to the device.

It is a good idea to touch the chassis with your finger before handling any electrostatic sensitive device. Any static electricity will be discharged to chassis ground and will not be transferred to the device.

Always store devices (cards, other electronic components) in ESD protective bags when not being handled.

### Unpacking Procedure

Remove the protective shipping and packing material from the card. Ensure contact wedges and other shipping devices have been removed.

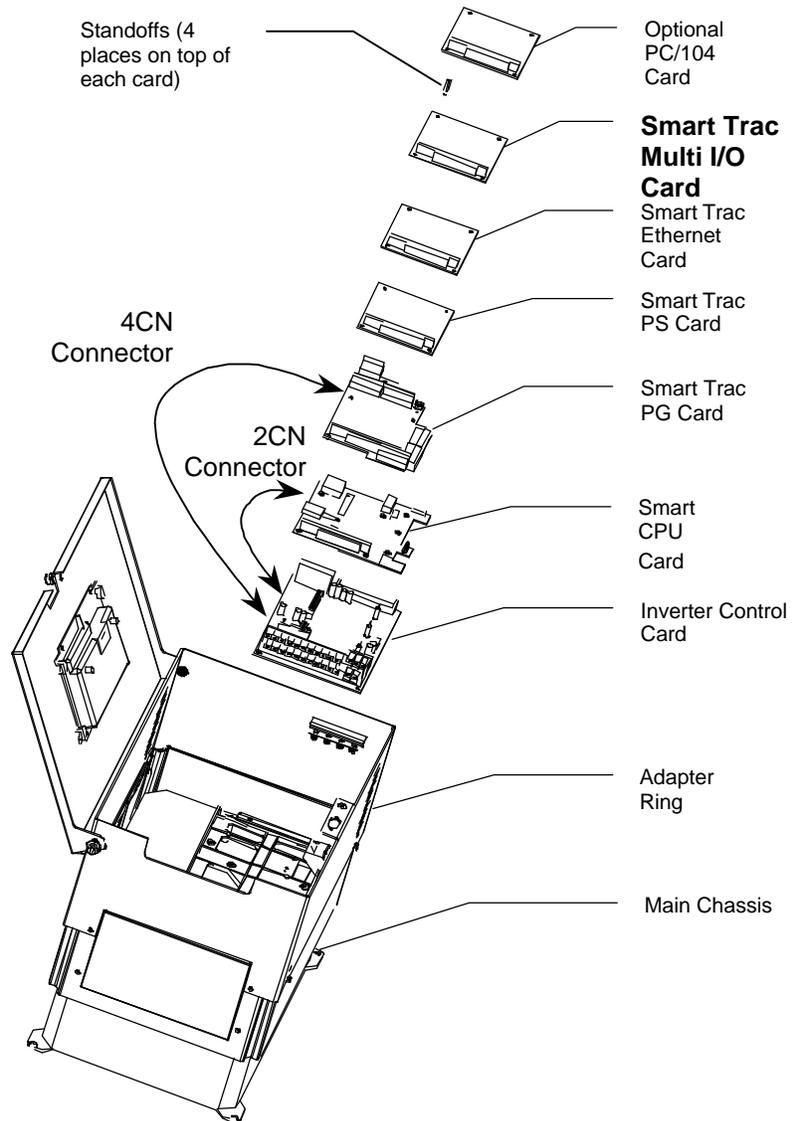
## Installing the Smart Trac DM6420 Multi I/O Card

The Smart Trac DM6420 Multi I/O Card is PC/104 compatible, so it may be positioned as one of two PC/104 option cards at the very top of the Smart Trac card stack, just above the Ethernet card or another PC/104 option card.

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**NOTE:** If replacing or adding a Smart Trac DM6420 Multi I/O card to an existing Smart Trac card stack, see "Appendix C – Removing the Smart Trac Card Stack" before continuing.

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*Figure 2. Smart Trac Multi-I/O Card Stack Position*

1. To install the Multi I/O card, orient the pins on the card with the female pin connector on the card below it (normally the Ethernet card). Gently but firmly push the Smart Trac DM6420 Multi I/O card onto the card below it. Make sure connecting pins are in alignment before pushing the two boards tightly together. Secure the card using four (4) metal standoffs.

- 
2. Replace all other cards, securing each with four (4) metal standoffs and the reverse of steps in "Appendix C – Removing the Smart Trac Card Stack".

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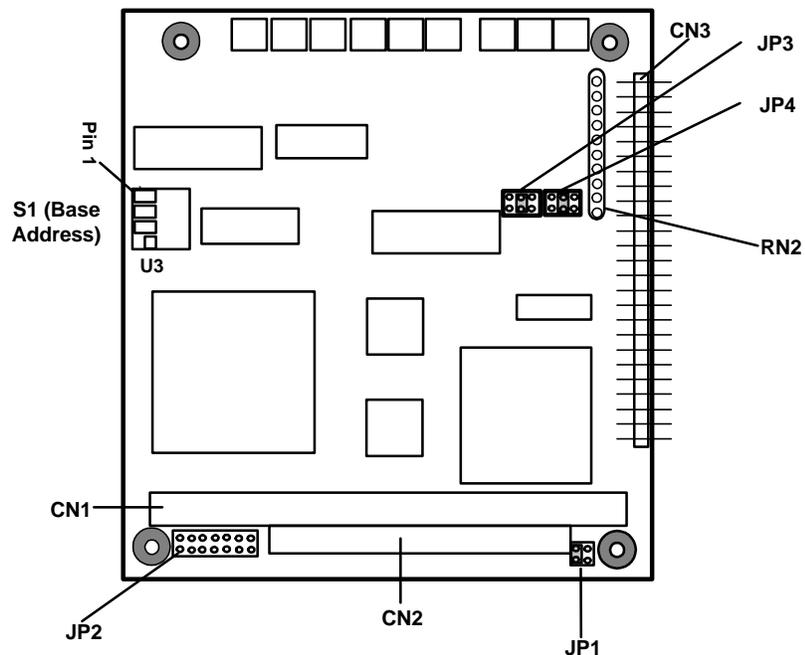
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# Configuring the Smart Trac DM6420 Multi I/O Card

## Configuration

You configure the Smart Trac DM6420 Multi I/O card by either accepting default values or changing them to suit your unique situation. The values chosen at installation of the Smart Trac DM6420 Multi I/O driver must match those set on the card.

## Card Layout



*Figure 3. Smart Trac DM6420 Multi I/O Card Layout*

## Default Settings

The Smart Trac DM6420 Multi I/O card is shipped from the factory already configured for the typical installation. The default values are:

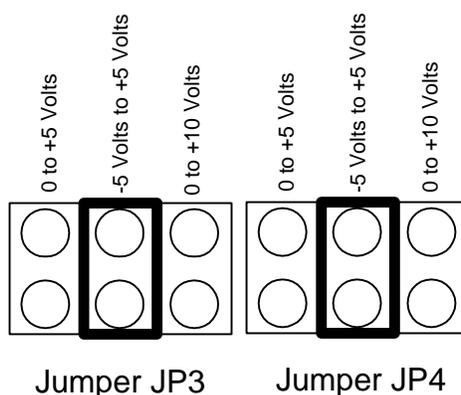
- **JP1:** Not Used.
- **JP2:** Not Used.
- **D/A output voltage range for DAC1 (JP3):**  $\pm 5$  volts ( $-5$  to  $+5$  volts).
- **D/A output voltage range for DAC2 (JP4):**  $\pm 5$  volts ( $-5$  to  $+5$  volts).
- **Port 0 Pullup/Pulldown Resistors:** Pull up is default.
- **Port 1 Pullup/Pulldown Resistors:** Pull up is default.
- **Base I/O Address (Switch S1):**  $0x0300$  hex ( $768$  decimal).

## Non-Default Settings

Whenever possible, you should use the defaults for all cards of your Smart Trac Card stack. However, certain unusual situations will require non-default settings. This may be necessary, for instance, if two Smart Trac DM6420 Multi I/O cards are used in the stack.

### DAC1 (JP3)

D/A output voltage range for DAC1 (JP3): You may change the setting to  $0$  to  $+5$ ,  $\pm 5V$ , or  $+10$  V. This setting does not have to be the same as for DAC2 (JP4).



*Figure 4. Default jumper positions for JP3 and JP4.*

### DAC2 (JP4)

D/A output voltage range for DAC2 (JP4): You may change the setting to  $0$  to  $+5$ ,  $\pm 5V$ , or  $+10$  V. This setting does not have to be the same as for DAC1 (JP3).

### Pullup/Pulldown Resistors

Pullup resistors for Port 0 and Port 1 may be changed to Pulldown resistors if required for your application. Contact your MagneTek Application Engineer if you need bits pulled down or no resistors.

### Base I/O Address Switch S1

The Base I/O Address must be set to avoid conflicts with other cards or it will not function properly. You may select a different base I/O address but you must make sure to avoid address conflicts with other cards in your Smart Trac system.

Table 2. Possible Multi I/O Base Address Settings.

Base Address Switch S1 Settings					
Base Address (Hexadecimal)	Base Address (Decimal)	Switch Setting			
		4	3	2	1
0x200	512	0	0	0	0
0x220	544	0	0	0	1
0x240	576	0	0	1	0
0x260	608	0	0	1	1
0x280	640	0	1	0	0
0x2A0	672	0	1	0	0
0x2C0	704	0	1	1	0
0x2E0	736	0	1	1	1
<b>0x300</b>	<b>768</b>	<b>1</b>	<b>0</b>	<b>0</b>	<b>0</b>
0x320	800	1	0	0	1
0x340	832	1	0	1	0
0x360	864	1	0	1	1
0x380	896	1	1	0	0
0x3A0	928	1	1	0	1
0x3C0	960	1	1	1	0
0x3E0	992	1	1	1	1

0 = Closed      1= Open      Bold and Shaded value indicates default.

## CN3 Connector Pin Assignments

A 50-pin connector CN3 permits use of eight differential analog inputs (or sixteen single-ended analog inputs) and/or two analog outputs. You also make any desired digital I/O connections at this connector.

Make sure all unused pins are not connected.

<u>Diff. S.E.</u>		<u>Diff. SE</u>
AIN1+ AIN1	①	② AIN1- AIN9
AIN2+ AIN2	③	④ AIN2- AIN10
AIN3+ AIN3	⑤	⑥ AIN3- AIN11
AIN4+ AIN4	⑦	⑧ AIN4- AIN12
AIN5+ AIN5	⑨	⑩ AIN5- AIN13
AIN6+ AIN6	⑪	⑫ AIN6- AIN14
AIN7+ AIN7	⑬	⑭ AIN7- AIN15
AIN8+ AIN8	⑮	⑯ AIN8- AIN16
AOUT 1	⑰	⑱ ANALOG GROUND
AOUT 2	⑲	⑳ ANALOG GROUND
ANALOG GROUND	㉑	㉒ ANALOG GROUND
P0. 7	㉓	P1.7
P0. 6	㉔	P1.6
P0. 5	㉕	P1.5
P0. 4	㉖	P1.4
P0. 3	㉗	P1.3
P0. 2	㉘	P1.2
P0. 1	㉙	P1.1
P0. 0	㉚	P1.0
Unused	㉛	㉜ DIGITAL GROUND
Unused	㉝	Unused
Unused	㉞	Unused
Unused	㉟	Unused
Unused	㊱	Unused
Unused	㊲	DIGITAL GROUND

Figure 5. Connector CN3 I/O Pin Assignments.

## Connecting Analog Input Pins

You may set analog inputs for either single-ended or differential operation. You must decide between differential or single-ended. A mix of differential and single-ended is not permitted.

### Single-ended analog inputs

When operating in the single-ended mode:

1. Connect the high side of the analog input to one of the analog input channels, AIN1 through AIN16.
2. Connect the low side to an ANALOG GND (pins 18 and 20-22 on CN3). **Figure 6 shows how these connections are made.**

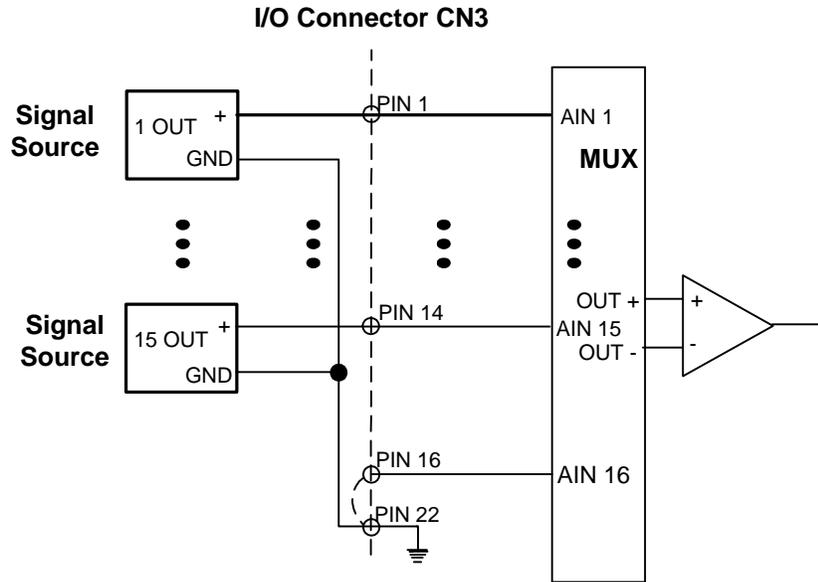


Figure 6. Single-Ended Input Connections.

### Differential analog inputs

When operating in the differential mode, twisted pair cable is recommended to reduce the effects of magnetic coupling at the inputs. Your signal source may or may not have a separate ground reference.

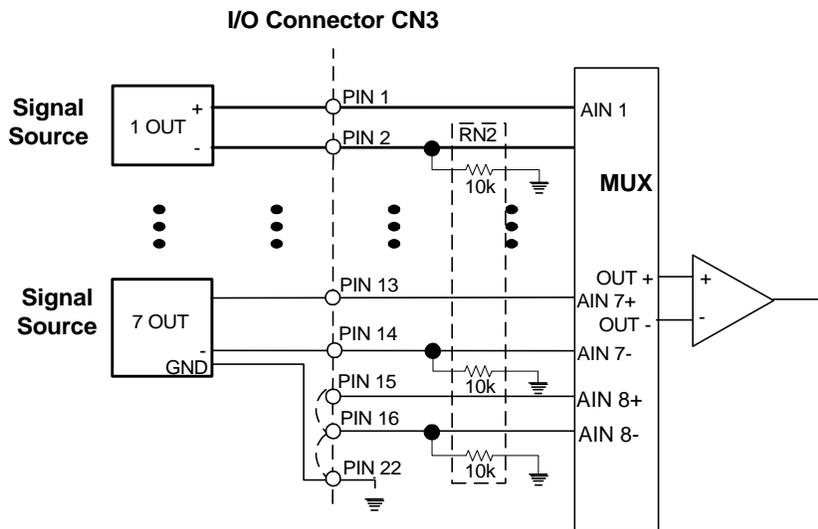


Figure 7. Differential Input Connections.

*When using the differential mode:*

1. Install a 10 kilohm resistor pack at location RN2 on the module to provide a reference to ground for signal sources without a separate ground reference.
2. Connect the high side of the analog input to the selected analog input channel, AIN1+ through AIN8+.
3. Connect the low side of the input to the corresponding AIN- pin.
4. For signal sources with a separate ground reference, connect the ground from the signal source to an ANALOG GND (pins 18 and 20-22 on CN3). **Figure 7 shows how these connections are made.**

## Connecting Analog Outputs

*To make an Analog Output connection, for each of the two D/A outputs:*

1. Connect the high side of the device receiving the output to the AOUT channel (CN3-17 or CN3-19).
2. Connect the low side of the device to an ANALOG GND (CN3-18 or CN3-20).

## Connecting Digital I/O

Digital connections consist of two eight-bit ports. Port 0 direction (Input or Output) is bit-programmable. Port 1 direction (Input or Output) is byte (port) programmable.

*To make a Digital I/O connection:*

1. Connect the high side of an external signal source or destination device to the appropriate signal pin on the I/O connector.
2. Connected the low side to any DIGITAL GND.

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# Testing Card Installation

## Testing the Installed Card

Once installed, you may test your Smart Trac DM6420 Multi I/O card by reading values at I/O points on the card.

Using a digital voltmeter or multimeter, measure the values at each of Input/Output CN3 connector terminals to see that inputs and outputs are active (See Figure 5). The readings should be the values defined by the CN3 connector and the gains used by the application program.

Run the application software to see if the drive is behaving properly.

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# Troubleshooting Your Smart Trac DM6420 Multi I/O Card

## Replace Card

Replace the suspect Smart Trac DM6420 Multi I/O card with a new one.

If the problem persists, the card is not the problem. You may need to contact your application engineer to determine whether the problem is software-related.

## Status and Error Messages

TBD

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# Appendix A – Technical Support

## Technical Support

Should you need technical assistance with installation or troubleshooting of your Smart Trac AC1, you can phone our Help Desk at either (800)-541-0939 or (262)-782-0200. *Alternatively, you may copy the **Problem Report** form, found on the next page, and fax it to us at (262)-782-3418.*

## References

*MagneTek Drives and Systems*

For more information about MagneTek drives and systems, training programs and contacts, visit:

<http://www.magnetekdrives.com>

*PC/104 Specification, Version 2.1*

PC/104 Consortium. An overview and the specification may be obtained at the web site address:

<http://www.controlled.com/pc104/index.html>

*Real Time Devices*

For additional information about the DM6420 Multi I/O card, visit the web site at:

<http://www.rtdusa.com>

## Problem Report

Name:

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Address:

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---

City:

State:

Zip

---

Serial Number:

DM6420 Multi I/O Card

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Occurrence:  Frequently  Intermittantly  Rarely

Nature of Problem:

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Conditions when problem occurs:

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# Appendix B – Replaceable Parts

## Replaceable Parts Listing

Description	MagneTek Part Number	Qty
Smart Trac DM6420 Multi I/O Card	46S03643-0050	Option
Technical Manual – Smart Trac DM6420 Multi I/O Card	TM 3554-0050	1
Standoff, 4.5mm, Hex, Stl, CL ZINC, 15mm M/F, M3, M3	05P00618-0006	4 each Multi I/O assy.
Card Extraction Tool	(Parvus Corporation P/N PRV-0760A-01	Option
Hardware Tools Kit for Smart Trac AC1	TBD	Option

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# Appendix C – Removing the Smart Trac Card Stack

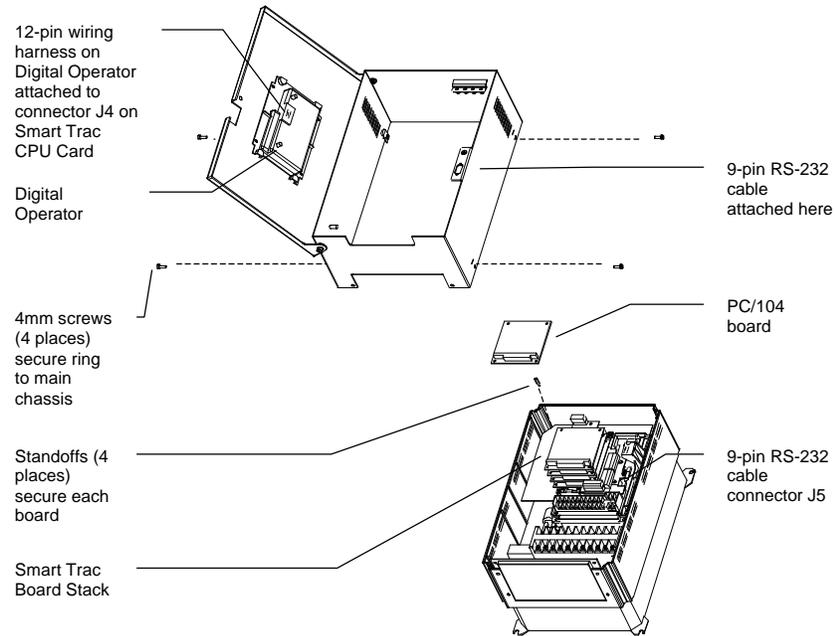
## General Procedures

1. Power off the Smart Trac AC1. Disconnect it and tag "Out of Service".
2. Do one of the following:
  - Open the cover to the Smart Trac AC1 by rotating the spring-loaded, captive screw counterclockwise. Use a large screwdriver if necessary to free the slotted screw.

OR

- Loosen the screws holding down the cover.
3. Disconnect the 12-pin wiring harness from connector J4 at the digital operator.
  4. Using the Phillips head screwdriver, remove the ground strap from the left inside and the ground strap from the top inside of the Smart Trac AC1 adapter ring.
  5. Disconnect the 9-pin RS-232 cable at connector J5 on the Smart Trac CPU card.

## Smart Trac DM6420 Multi I/O Card



6. Using a 4.5mm hex head driver, remove four standoffs from the topmost card.
7. Using the PC/104 extraction tool, remove the topmost card from the stack.

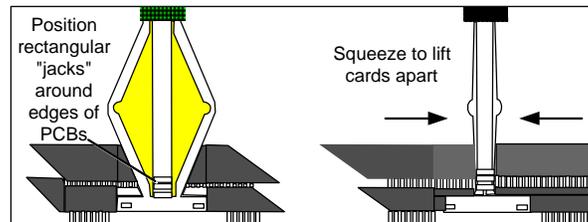


Figure 8. Using the PC/104 Extraction Tool.

8. Repeat step 8 above until all PC/104 cards have been removed.
9. To remove the Smart Trac PG card:
  - Disconnect the 4CN connector on the PG card.
  - Using a tubular extraction tool or pliers, squeeze the plastic, spring-loaded retainer built-in to the long plastic standoff located at the top of the PG card, just above connector J6.
  - Using a PC/104 extraction tool, remove the card.

**NOTE:** The Smart Trac PG card requires unique handling. Wedge the extracting tool between the PG card and the CPU card. The area between the terminal strip on the CPU card and the serial numbered edge of the PG card can be lifted first, then the opposite side (nearest TB1) on the PG card). Alternate sides until the card is free of the CPU card.

10. To remove the Smart Trac CPU card:

- Disconnect the card at the 2CN connector on the CPU card.
- The CPU card is secured with three plastic standoffs with spring-loaded clips on the end. Squeeze the top of the standoffs (the clips) with the special cylindrical removal tool, your fingers or needle-nosed pliers and lift the CPU card from the Smart Trac Inverter Control Card.

You have removed the entire card stack. The inverter card, considered part of the drive, is in clear view.



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# Glossary of Terms

**differential operation**

Operation in which a two-wire signal references the positive of the pair to the minus of the pair instead of to ground. The minus of the pair is implied to be ground.

**PC/104 specification**

An embedded PC bus standard. The standard defines the mechanical size of a self-stacking bus. Also an IEEE draft standard, called the P996.1 Standard for Compact Embedded PC Modules, PC/104 Specification, Version 2.1, July 1994, PC/104 Consortium.

**single-ended operation**

Operation in which the signal is referenced to ground.

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# *SMART TRAC DM6420 Multi I/O Card*

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MagneTek  
Drives and Systems  
16555 West Ryerson Road  
New Berlin, WI 53151  
(800) 541-0939, (262) 782-0200, FAX (414) 782-3418

