# *SMART TRAC*™ *CPU Card*

# Contents

# Appendix A – Technical Support      23

# Appendix B – Replaceable Parts      27

# Appendix C – Removing the Smart Trac Card Stack      29

# Glossary of Terms      33

# Index      35

# 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.

**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.

*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.

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## 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.

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# 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.

# Smart Trac CPU Card

## General Capabilities

The Smart Trac CPU card permits a Smart Trac AC1 to be quickly programmed for custom applications using IEC-61131-3 languages. These languages include Relay Ladder Logic (RLL), Sequential Function Charts (SFC), Function Block (FB) diagrams, Structured Text (ST), Instruction List (IL) and function blocks written in the C programming language. It also provides for easily expanded communications and/or extra Input/Output capabilities.

The card executes user's programs, provides the interface between the digital operator and the rest of the Smart Trac AC1, and communicates with other computers for download, upload and monitoring of programs and data. It connects to cards conforming to the PC/104 Specification. Several cards, including option cards, may be added to interact with the Smart Trac CPU card including: the Smart Trac PG card; Smart Trac Ethernet, Smart Trac LAN, DeviceNet, Genius PCIM, Modbus, Profi-bus communications cards; and the Smart Trac Multi-I/O card.

All option cards conform to the PC/104 Specification, Version 2.1. They stack with the Smart Trac CPU card using its PC/104 expansion bus connector. The Smart Trac CPU conforms to the PC/104 expansion bus.

## Specifications

- Intel 486DX2/66 Mhz processor with 4 Megabytes RAM

- PC/104 expansion bus connector

- Executes programs compliant with IEC-61131-3 languages

- Isolated RS-232 Serial port

- 2 Megabytes programmable flash ROM

- 512 bytes Dual-port RAM

- 32 Kilobytes nonvolatile RAM

- Battery-backed real-time clock

- Chart recording buffer of up to 10 Smart Trac AC1 parameters

- On-board self-test runs at boot-up

# Quick Start

1. Power OFF your Smart Trac AC1.

2. Remove all cards in the Smart Trac card stack except for the Inverter card (bottom most card of the stack). The Smart Trac CPU card is last to be removed.

3. Install the replacement Smart Trac CPU Card in your Smart Trac AC1 in the position just above the inverter card.

4. Replace all other cards in their proper position in the card stack.

5. Power up your Smart Trac AC1.

6. Set the Smart Trac system clock and any other boot menu parameters your application may require.

7. Test your Smart Trac system.

# Installing the Smart Trac CPU Card

## Unpacking

**Electrostatic Sensitive Discharge (ESD) Procedures**

| WARNING - ESD |
|---|
| Keep electronic circuit boards in Electrostatic Discharge (ESD) sensitive 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 CPU Card

The Smart Trac CPU Card must be positioned above the Smart Trac Inverter Control card.

**NOTE:** If replacing a Smart Trac CPU card to an existing Smart Trac card stack, see Appendix D – "Removing the Smart Trac Card Stack" before continuing.
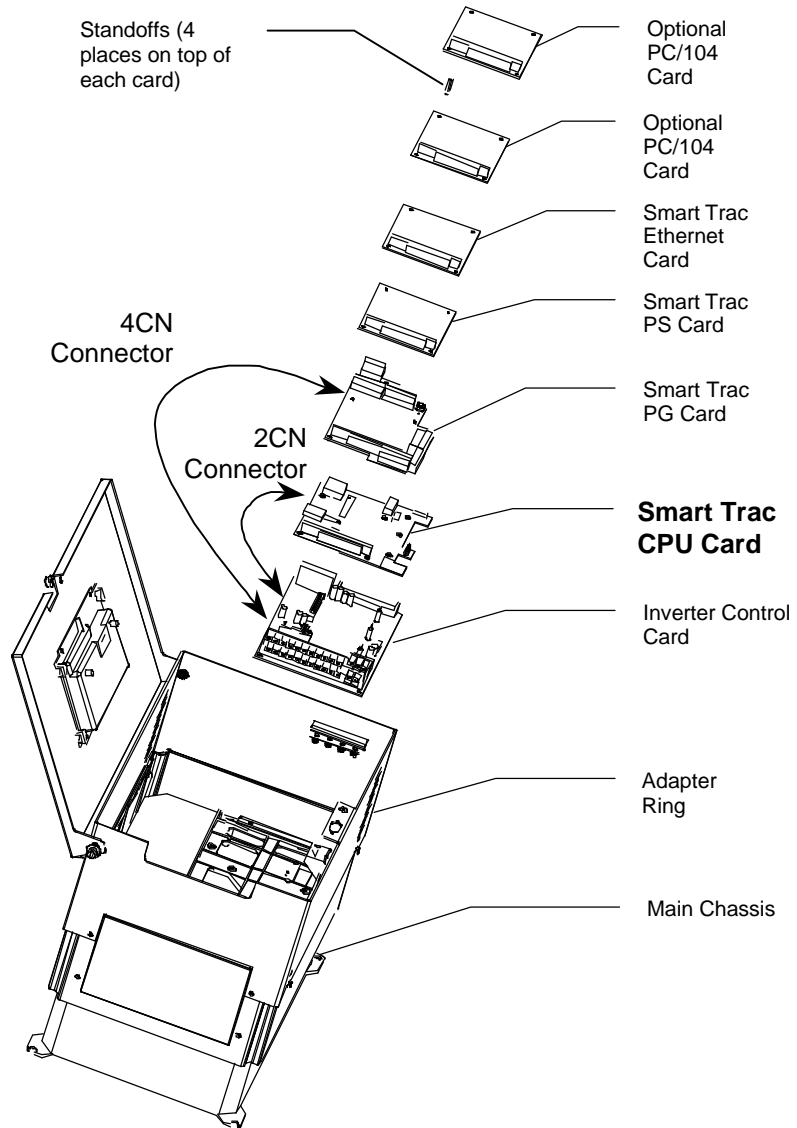
*Figure 1. Smart Trac CPU Card Stack Position.*

1. Install the Smart Trac CPU card. Align the male PC/104 connector pins on the Smart Trac CPU card with the female PC/104 connector on the Inverter and the standoff holes with metal standoffs on the Inverter. When in place, gently but firmly push the Smart Trac CPU card in place on the Inverter card.

2. Orient the PG card so that the PC/104 connector and the J2 connector align with the PC/104 connector on the Smart Trac CPU card and the 4CN connector on the Inverter Control board. Be careful to align the PC/104 connector pins with the receptacle on the Smart Trac CPU card so the pins don't bend when the card is pushed into place.

3. Gently but firmly push the Smart Trac PG card onto the Smart Trac CPU card. Make sure connecting pins are in alignment and J2 mates with 4CN before pushing the two boards tightly together. Secure the card using four (4) metal standoffs and one (1) plastic standoff.

4. Replace the Smart Trac PG Card and other cards by reversing the instructions in "Appendix C – Removing the Smart Trac Card Stack".

# Interrupts and Addresses Used by the Smart Trac CPU Card

## Configuration

No configuration switches or jumpers exist on the Smart Trac CPU card. You simply install the card and connect it as described in "Installing the Smart Trac CPU Card."

## Default Interrupts and Base I/O Addresses

| Interrupt | Smart Trac Use | Address |
|-----------|---------------|---------|
| IRQ0 | System, timer | |
| IRQ1 | Systsem, unused | |
| IRQ2 | Not available | 0x2e0 |
| IRQ3 | COM2 Serial Port | 0x2f8 |
| IRQ4 | COM1 Serial Port - Digital Operator Port | 0x3f8 |
| IRQ5 | Ethernet card default | 0x320 |
| IRQ6 | Available for PC/104 option cards | |
| IRQ7 | DeviceNet card default | 0x250 |
| IRQ8 | System, Real-time Clock | |
| IRQ9 | ARCNET cascaded IRQ2 default | 0x2e0 |
| IRQ10 | System, Internal Heartbeat | --- |
| IRQ11 | Smart Trac Genius PCIM default | |
| IRQ12 | Available for PC/104 option cards | |
| IRQ13 | System, Math coprocessor | |
| IRQ14 | Available for PC/104 option cards | |
| IRQ15 | Not Available in Smart Trac | |

# Smart Trac CPU Card Layout
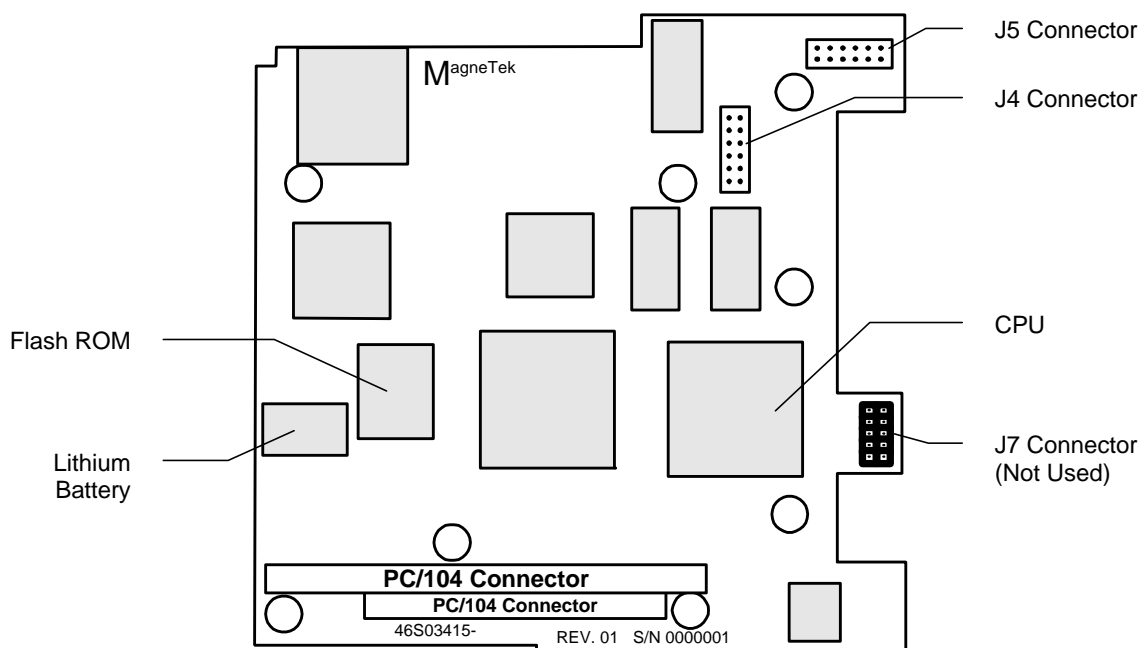


*Figure 2. Smart Trac CPU Card Layout.*

# J5 Connector Pinout

The pinout of Smart Trac CPU card connector J5 is shown in the table below. One end of a ribbon cable plugs into J5 on the CPU card and the other end of the cable plugs into DB9 connector on the front of the Smart Trac unit. The DB9 Connector, with only 9 pins, has no connection to the J5 pin.

| Smart Trac CPU card connector DB9 Pin # | Smart Trac Unit connector J5 Pin # | Signal Abbreviation | Signal Description |
|---|---|---|---|
| 1 | 1 | NC | No Connection |
| 2 | 3 | Tx | Transmit (from CPU) |
| 3 | 5 | Rx | Receive (to CPU) |
| 4 | 7 | NC | No Connection |
| 5 | 9 | C5ISO | Common |
| 6 | 2 | NC | No Connection |
| 7 | 4 | CTS | Clear to Send (to CPU) |
| 8 | 6 | RTS | Request to Send (from CPU) |
| 9 | 8 | NC | No Connection |
| - | 10 | NC | No Connection |

# Testing Card Installation

## Booting and Power-Up Self-Test

Immediately after power-up of the Smart Trac AC1 with the CPU card installed, the validity of the operating system is checked. The Smart Trac AC1 BIOS (Basic Input Output System) performs a self-test to determine the integrity of RAM, flash memory, system timers and interrupts, among other checks. Any detected faults appear on the Smart Trac AC1 digital operator.

Next, the system loads any installed drivers. It checks the validity of the user program before starting its execution.

Once drivers are installed and the user program is validated, the system performs according to the user program, responding with diagnostics and error handling as necessary.

**NOTE**: If communication with the Smart Trac CPU and other cards in the Smart Trac AC1 are not established within seven (7) seconds of power-up or after about two (2) seconds without data being transferred, it will shut down. The LEDs on the digital operator will flash, indicating this lack of communication.

## Normal Boot Messages

When you power-up your Smart Trac AC1, the operating system running within the CPU displays a series of messages on the Digital Operator.

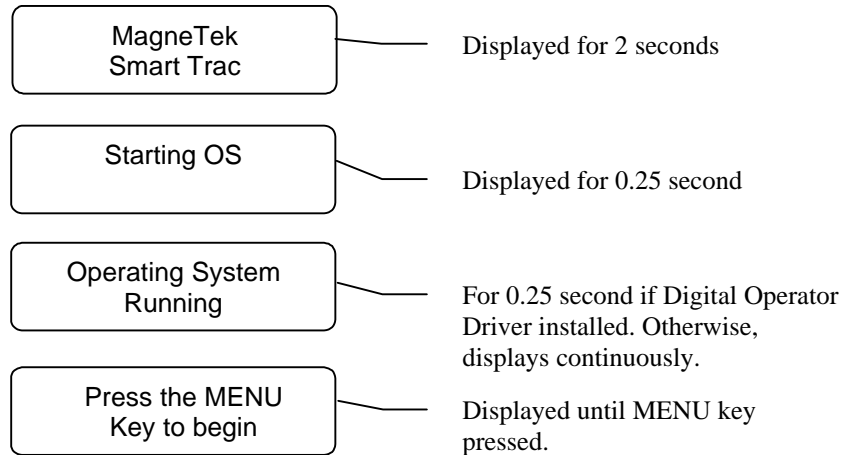If MENU key is not pressed at power up, here is what you see:

| MagneTek<br>Smart Trac | Displayed for 2 seconds |
| --- | --- |

| Starting OS | Displayed for 0.25 second |
| --- | --- |

| Operating System<br>Running | For 0.25 second if Digital Operator<br>Driver installed. Otherwise,<br>displays continuously. |
| --- | --- |

| Press the MENU<br>Key to begin | Displayed until MENU key<br>pressed. |
| --- | --- |

*Figure 3. Normal Boot Messages.*

If you press the Menu key on the Digital Operator within 2 seconds of the start of the boot process, you will access the Boot Menu, allowing you to configure various operating parameters. These parameters include TCP/IP Configuration, Inverter Type, COM1 Configuration, Serial Download from COM1 or Flash Memory erasure or programming mode, a check of the firmware version, and Flash ROM access.

NOTE: The second boot message "Starting OS" can be read as an ASCII string, output from serial port J5.

# Troubleshooting Your Smart Trac CPU Card

## Operating System Status and Error Messages

Your application program may include programming code to display the following messages on the Smart Trac AC1 Digital Operator.

These errors are OR'd with 0x80000000 before displaying on the Digital Operator.

| Possible Smart Trac Operating System Status and Error Messages | | |
|---|---|---|
| **Message** | **Hexa-decimal Address** | **Meaning** |
| PCODE_SUCCESS | 0x00000000 | |
| PROG_EXIT | 0x00000000 | |
| CONTINUE | 0x00000001 | |
| INVALID_OPCODE | 0x00000002 | Std. Major Fault - |
| PSTACK_OVERFLOW | 0x00000003 | Std. Major Fault - |
| PSTACK_UNDERFLOW | 0x00000004 | Std. Major Fault - |
| PSTACK_CORRUPTED | 0x00000005 | Std. Major Fault - |
| BSTACK_UNDERFLOW | 0x00000006 | Std. Major Fault - |
| BSTACK_OVERFLOW | 0x00000007 | Std. Major Fault - |
| CSTACK_CORRUPTED | 0x00000008 | |
| OPERAND_UNDERFLOW | 0x00000009 | Std. Minor Fault - |
| DIVIDE_BY_ZERO | 0x0000000A | Std. Minor Fault - |
| RESULT_UNDERFLOW | 0x0000000B | Std. Minor Fault - |
| RESULT_OVERFLOW | 0x0000000C | Std. Minor Fault - |
| INVALID_RESULT | 0x0000000D | Std. Minor Fault - |
| ADDR_MODE_UNKNOWN | 0x0000000E | Std. Major Fault - |
| ADDR_TYPE_MISMATCH | 0x0000000F | Std. Major Fault - |
| DATA_TYPE_UNKNOWN | 0x00000010 | Std. Major Fault - |
| DATA_TYPE_MISMATCH | 0x00000012 | Std. Major Fault - |
| INVALID_DATA_TYPE | 0x00000013 | Std. Major Fault - |
| INVALID_ADDRESS | 0x00000014 | Std. Major Fault - |
| OPERAND2_INVALID | 0x00000015 | Std. Major Fault - |
| OPERAND1_INVALID | 0x00000016 | Std. Major Fault - |
| JUMP_OUTOF_BOUNDS | 0x00000017 | Std. Major Fault - |
| ADDR_OUTOF_BOUNDS | 0x00000018 | Std. Major Fault - |
| UNKNOWN_FLOAT_ERROR | 0x00000019 | Std. Minor Fault - |
| FSTACK_OVERFLOW | 0x0000001A | Std. Minor Fault - |

| Possible Smart Trac Operating System Status and Error Messages | | |
|---|---|---|
| Message | Hexa-decimal Address | Meaning |
| FSTACK_UNDERFLOW | 0x0000001B | Std. Minor Fault - |
| INVALID_OPERAND | 0x0000001C | Std. Major Fault - |
| NEG_VALUE | 0x0000001D | Std. Minor Fault - |
| MALLOC_FAILED | 0x0000001E | Std. Major Fault - |
| INVALID_ACTION | 0x0000001F | Std. Major Fault - |
| IO_READ_FAILED | 0x00000020 | Std. Major Fault - |
| IO_WRITE_FAILED | 0x00000021 | Std. Major Fault - |
| CCALL_FAILED | 0x00000022 | Std. Major Fault - |
| STRING_OVERRUN | 0x00000023 | Std. Minor Fault - |
| NUM_SHIFTBITS_NEG | 0x00000024 | Std. Minor Fault - |
| INVALID_COERCION | 0x00000025 | Std. Major Fault - |
| INVALID_ADDR_MODE | 0x00000026 | |
| INVALID_BIT_NUM | 0x00000027 | |
| INVALID_DATASIZE | 0x00000028 | |
| BIT_NUM_OUT_OF_RNG | 0x00000029 | |
| INVALID_C_FUNC_PTR | 0x0000002A | |
| INVALID_LOWER_BND | 0x0000002B | |
| INVALID_UPPER_BND | 0x0000002C | |
| DATE_TIME_INVALID | 0x0000002D | |
| MSG_STRLEN_INVALID | 0x00004000 | |
| USER_TASK_HUNG | 0x00007FF8 | |
| NO_STARTUP_ROUTINE | 0x00007FF9 | |
| BREAKPOINT_SET | 0x00007FFA | |
| OFFSET_OUT_OF_RNG | 0x00007FFB | Std. Major Fault - |
| TASK_OVERRUN | 0x00007FFC | Std. Major Fault - |
| TASK_RESTART_FAIL | 0x00007FFD | Std. Major Fault - |
| WATCHDOG_TIMEOUT | 0x00007FFE | Std. Major Fault - |
| OH_SHTUFF | 0x00007FFF | Std. Major Fault - |

These following error codes are not OR'ed with 0x80000000.

| Hardware Abstraction Layer Error Codes. | | |
|---|---|---|
| Message | Hexa-decimal Address | Meaning |
| HAL_SUCCESS | 0x0000 | |
| HAL_STARTED | 0x00020000 | |
| HAL_STOPPED | 0x00020001 | |
| HAL_INVALID_CMD | 0x00020002 | |
| HAL_NOTASKS | 0x00020003 | |
| HAL_CREATETASKFAILED | 0x00020004 | |
| HAL_TOO_MUCHDATA | 0x00020005 | |
| HAL_NOSTACKMEM | 0x00020006 | |
| HAL_FORCE_NOTENABLED | 0x00020007 | |
| HAL_FORCE_ADDRINVALID | 0x00020008 | |
| HAL_RTLIB_INDEX_ERR | 0x00020009 | Runtime library index error |
| HAL_INVALID_IOHANDLE | 0x00020010 | Invalid I/O handle |
| HAL_CANNOT_SET_FORCED_MEM | 0x00020011 | Cannot set forced memory |
| HAL_IO_LT_BIND_FAILED | 0x00020012 | |
| HAL_DOWNLOAD_ACTIVE | 0x00020013 | Download active |
| HAL_PROG_RUNNING | 0x00020014 | An application program is running |
| HAL_TASK_NOT_FOUND | 0x00020015 | Cannot find task in ??? |
| HAL_MEM_CORRUPT | 0x00020016 | Memory corrupt |
| HAL_NOPROG_LOADED | 0x00020017 | No program loaded |
| HAL_START_IO_FAILED | 0x00020018 | Start of I/O failed |
| HAL_INVALID_ADDR | 0x00020019 | Invalid address |
| HAL_DOWNLOAD_INACTIVE | 0x00020020 | Download Inactive |

| Hardware Abstraction Layer Error Codes. | | |
|---|---|---|
| **Message** | **Hexa-decimal Address** | **Meaning** |
| HAL_INVALID_TASKTYPE | 0x00020021 | Invalid Task Type |
| HAL_IOINIT_FAILED | 0x00020022 | I/O Initialization procedure has failed. |
| HAL_TASKINDEX_INVALID | 0x00020023 | Task index invalid |
| HAL_ETHERNET_DRV_BAD | 0x00020024 | Ethernet drive does not pass tests |
| HAL_ETHCFG_OPEN_FAILED | 0x00020025 | An attempt to open the Ethernet configuration failed. |
| HAL_ETHCFG_WRITE_FAILED | 0x00020026 | An attempt to write the Ethernet configuration failed. |
| HAL_NOMEM | 0x00020027 | No memory found during diagnostics. |
| HAL_THREAD_PRIO_FAILED | 0x00020028 | Thread priority failed. |
| HAL_DOWNLOAD_DISABLED | 0x00020029 | Download of programs and data is disabled. |
| HAL_NODENAME_MISMATCH | 0x00020030 | The nodename does not match those known by the Smart Trac system. |
| HAL_STATIC_STORAGE_OPEN_FAILED | 0x00020031 | |
| HAL_STATIC_STORAGE_CLEAR_FAILED | 0x00020032 | |
| HAL_STATIC_STORAGE_WRITE_FAILED | 0x00020033 | |
| HAL_STATIC_STORAGE_READ_FAILED | 0x00020034 | |
| HAL_STATIC_STORAGE_CLOSE_FAILED | 0x00020035 | |
| HAL_STATIC_STORAGE_BAD_FORMAT | 0x00020036 | |
| HAL_UNABLE_TO_CLEAR_MEM | 0x00020037 | Not able to clear CPU memory. |
| HAL_INVALID_SUBCMD | 0x00020038 | Invalid subcommand. |
| HAL_BLDNUM_MISMATCH | 0x00020039 | |
| HAL_STOP_IO_FAILED | 0x00020040 | An attempt to stop the I/O has failed. |
| HAL_INVALID_NUM_PROGS | 0x00020041 | The number programs indicated are invalid. |
| HAL_DUPLICATE_CONT_TASK | 0x00020042 | |
| HAL_TOO_MANY_CARDS_PER_TASK | 0x00020043 | Too many cards per task. |
| HAL_STATIC_STORAGE_CHKSUM_INVALID | 0x00020044 | A checksum test of static storage on the CPU card is invalid. |
| HAL_KERNEL_PROGRAM_IN_PROGRESS | 0x00020045 | A download of the Kernel is in progress. |
| HAL_INVALID_TASK_PRIORITY | 0x00020046 | |
| HAL_ADDRESS_OUT_OF_RANGE | 0x00020047 | A memory or I/O address is out of valid ranges. |
| HAL_KERNEL_DWNLD_ABORTED | 0x00020048 | A download of the kernel has been aborted. |
| HAL_NO_RT_EXEC_KEY | 0x00020049 | |
| HAL_UNABLE_TO_SAVE_RT_EXEC_KEY | 0x00020050 | |
| HAL_NUM_EXPORT_ENTRIES_MISMATCH | 0x00020051 | |
| HAL_NUM_IMPORT_ENTRIES_MISMATCH | 0x00020052 | |
| HAL_DLL_NAME_LENGTH_OVERRUN | 0x00020053 | |
| HAL_LATEBIND_IO_TOO_FEW_FUNCTIONS | 0x00020054 | |
| HAL_INVALID_SW_REVISION | 0x00020055 | Invalid Operating System Software Revision |
| HAL_INVALID_RT_FUNCTION | 0x00020056 | A runtime library function was attempted for use but is invalid. |
| HAL_LOAD_LIBRARY_FAILED | 0x00020057 | |

| Hardware Abstraction Layer Error Codes. | | |
|---|---|---|
| **Message** | **Hexa-decimal Address** | **Meaning** |
| HAL_DATA_TABLE_PTR_MISMATCH | 0x00020058 | A pointer within a data table does not match any known pointers. |
| HAL_DATA_TABLE_SIZE_MISMATCH | 0x00020059 | The sizes of data and the associated table are different. |
| HAL_INVALID_SYNC_TASK | 0x00020060 | |
| HAL_INVALID_SYNC_CARD | 0x00020061 | |
| HAL_OPERATION_NOT_SUPPORTED | 0x00020062 | |
| HAL_NO_ROOM_FOR_SOURCE | 0x00020063 | |
| HAL_NO_SOURCE_TO_UPLOAD | 0x00020064 | |
| HAL_UNABLE_TO_SAVE_SOURCE_TO_DISK | 0x00020065 | |
| HAL_SOURCE_OFFSET_INVALID | 0x00020066 | |
| HAL_INVALID_TIME_DATE | 0x00020067 | |
| HAL_NO_ROOM_FOR_DB | 0x00020068 | |
| HAL_NO_DB_MEMORY | 0x00020067 | |
| HAL_DB_INVALID_TYPE | 0x00020068 | |
| HAL_ENGINE_MISMATCH | 0x00020069 | |
| HAL_SERIAL_CMD_INVALID | 0x00020070 | |
| HAL_UNABLE_TO_OBTAIN_DATA_MUTEX | 0x00020071 | |
| HAL_CARD_NOT_FOUND | 0x00020072 | |
| HAL_ENUM_COMPLETE | 0x00020073 | |
| HAL_INVALID_DATA_TABLE | 0x00020074 | |
| HAL_INVALID_SYMTABLE_ADDR | 0x00020075 | |
| HAL_INVALID_SYMTABLE_SIZE | 0x00020076 | |
| HAL_ADDRESS_MISMATCH | 0x00020077 | |
| HAL_IO_PRESCAN_FAILED | 0x00020078 | |

# Offset Kernel/Boot Download Errors to 20100 - 20149

| Offset Kernel/Boot Download Errors to 20100 - 20149. | | |
|---|---|---|
| **Message** | **Hexa-decimal Address** | **Meaning** |
| HAL_KERNEL_ERR_OFFSET | 0x00020100 | |
| HAL_NO_KERNEL_DOWNLOAD_IN_PROGRESS | 0x00020100 | |
| HAL_INVALID_KERNEL_CHECKSUM | 0x00020101 | |
| HAL_INVALID_KERNEL_XFER_TYPE | 0x00020102 | |

# Offset I/O Errors from 1 - 59 to 20201 - 20259.

| Offset I/O Errors from 1 - 59 to 20201 - 20259 | | |
|---|---|---|
| **Message** | **Hexa-decimal Address** | **Meaning** |
| HAL_IO_ERR_OFFSET | 0x00020200 | |
| | | |

# Offset Trace Errors to 20300 to 20399

| Offset Trace Errors to 20300 to 20399 | | |
| --- | --- | --- |
| Message | Hexa-decimal Address | Meaning |
| HAL_ERR_TRACE_ENABLED. | 0x00020300 | |
| HAL_ILLEGAL_CONDITION. | 0x00020301 | |
| HAL_TRACE_PIPE_BROKEN | 0x00020302 | |
| HAL_TRACE_PIPE_OVERFLOW | 0x00020303 | |
| HAL_TRACE_PIPE_WRITE_FAILED | 0x00020304 | |
| HAL_INVALID_TRACE_HANDLE. | 0x00020305 | |
| HAL_TOO_MANY_TRACE_PARAMS | 0x00020306 | |
| HAL_TRACE_INVALID_EVENT_INDEX | 0x00020307 | |
| HAL_TRACE_EVENT_NOT_CONFIGURED | 0x00020308 | |

# Troubleshooting CPU Problems

**Battery Low**

Logic in Non-Volatile RAM (NVRAM) determines battery voltage each 24 hours. If a low voltage condition is detected, a message will appear on the Digital Operator.

**Note**: If the voltage is low, it sets a bit register. The bit may be read and interpreted by an application program, so that when the CPU Card's battery reaches a low charge state, a message will appear on the Digital Operator.

# Problems with Other Cards

Several optional cards may be used with your Smart Trac AC1, all controlled by the CPU card. To attempt to provide detailed troubleshooting procedures for each of these in this manual would be impractical.

If you experience problems with network communications or input/output, isolate the problem to the card level and consult the specific manual that shipped with the card.

# Corrective Maintenance

## Replacing the Battery

An on-board Lithium battery provides power to NVRAM and maintains the system time and date. See "Smart Trac CPU Card Layout" for location of the battery on the CPU Card.

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### CAUTION

To avoid draining battery do NOT place SNAPHAT pins in a conductive foam.

To avoid damaging SNAPHAT sockets do NOT wave solder SOIC.

Failure to comply may result in premature battery failure.

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*To replace the battery*:

1. Power OFF the Smart Trac AC1, lock out and tag "Out of Service."

2. Ensure all parameters held in NVRAM have been recorded. Loss of battery power or removal of the battery causes NVRAM to lose data normally retained. These values must be reentered after inserting a new battery.

3. Remove all cards above the CPU (including PC/104 option cards, Ethernet card, PS Card, and PG Card) according to "Installing the Smart Trac CPU Card."

4. Using a chip extractor tool, remove the battery from its socket on the card.

5. Carefully align pin 1 of the battery (corner of battery with the dot printed on it)  and gently but firmly push into place. A key on the battery prevents you from installing it with terminals reversed.

6. Replace all cards according card replacement steps in "Installing the Smart Trac CPU Card."

7. Reenter NVRAM functions (TCP/IP address, Inverter Type, COM1 baud rate, date and time).

# Battery Storage

Store batteries in a dry place. Storing unpackaged battery cells together could result in cell shorting and heat build-up.

# Proper Battery Disposal

When completely discharged, this type of lithium cell is Non-Hazardous per USEPA Criteria. Dispose of batteries according to appropriate Local, State and Federal waste regulations. For unreacted Lithium Metal, see the battery reference in the Appendix to this manual.

# Appendix A – Technical Support

## Getting Help

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

*Lithium Batteries Product Guide*

For a copy of this publication, contact Rayovac at 608-275-4735 or visit their web site at:

http://www.rayovac.com

# Problem Report

Name:

Address:

City:                                                        State:                        Zip

Serial Number:                                Smart Trac CPU Card:    ☐ 66Mhz           ☐ 100 Mhz

Occurrence:        ☐ Frequently        ☐ Intermittantly  ☐ Rarely

Nature of Problem:

Conditions when problem occurs:

# Appendix B – Replaceable Parts

## Replaceable Parts Listing

| Description | MagneTek Part Number | Qty |
|---|---|---|
| Smart Trac CPU Card option kit | 46S03643-0010 | 1 |
| Standoff, 4.5mm, Hex, Stl, CL ZINC, 15mm, M/F, M3, M3 | 05P00618-0006 | 3 each CPU assy. |
| Standoff, 4.5mm, Hex, Stl, CL ZINC, 14mm, M/F, M3, M3 | 05P00618-0005 | 1 each CPU assy. |
| Battery, Lithium | | 1 |
| Technical Manual – Smart Trac CPU Card | TM 3415-0010 | 1 |
| Card Extraction Tool | (Parvus Corporation P/N PRV-0760A-01 | |
| 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.
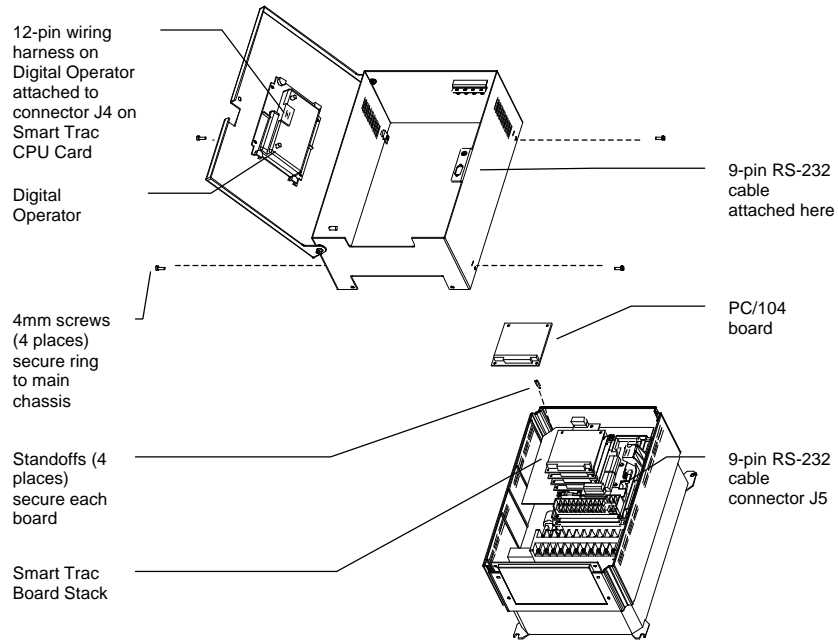
6. Using a 4.5mm hex head driver, remove four standoffs from the topmost card.

7. Using the PC/104 extraction tool, remove the topmost card from the stack.
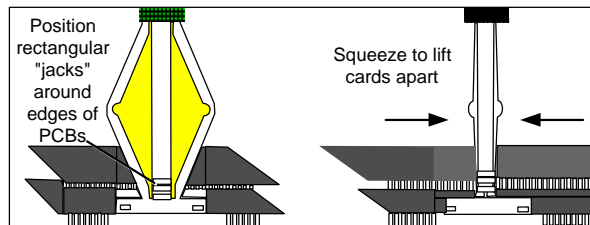


*Figure 4. Using the PC/104 Extraction Tool.*

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.

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**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.

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10. *To remove the Smart Trac CPU card*:

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- 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.

# Glossary of Terms

| | |
|---|---|
| **Function Block** | One of three Program Control Unit types. A programming language element, typically represented by a graphical block, consisting of inputs, outputs, internal variables, and a set of operations. Function blocks are instantiated and can contain state information from one invocation of an instantiation to the next. |
| **IEC-61131-3 languages** | Part 3 of the international standard on Programmable Controllers, which specifies Programming Languages, including Relay Ladder Logic (RLL), Structured Text (ST), Sequential Function Charts (SFC), Function Blocks (FB), and Instruction Lists (IL). |
| **Instruction List** | The IEC 61131-3 Instruction List language for programmable controllers. Alternatively, a program control unit developed using the Instruction List language. |
| **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. |
| **Relay Ladder Logic** | An implementation of the IEC 61131-3 Ladder Diagram language. |
| **Sequential Function Charts** | The IEC-61131-3 defined Sequential Function Chart language used for programmable controllers or a program control unit developed using Sequential Function Chart language. |
| **Structured Text** | The Structured Text language specified by IEC 61131-3 used in programmable controllers. It provides a structured programming environment similar to that in the computer programming language PASCAL. |

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# Index

Troubleshooting Your Smart Trac
CPU Card 13

**W**

warranty 1–2
Warranty 2
wrist strap 5

# SMART TRAC CPU Card