



RD 790-20

REMOTE DEVICE
USER REFERENCE SHEET
FOR

**REMOTE DISPLAY CONTROLLER LAN NODE PCB
(RDC)**

Part No. 46S02790-0020, -0040, -0050, or -0060

For use on MicroTrac DSD Local Area Network

Effective 2/14/94

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INTRODUCTION

This document explains the hardware and software operations of the Remote Display Controller LAN Node PCB (RDC).

The Remote Display Controller LAN Node PCB (RDC) provides the MicroTrac DSD system with the ability to have remote displays with a minimal amount of wiring. The RDC can support up to 31 Remote Display Units (RDUs) through use of an RS-485 bidirectional serial data bus (see Table 1). Each RDU has a 16 character alphanumeric display and a 5-1/2 digit numeric display with a sign character. Any one or all of the RDUs may have a keypad or push buttons which will allow for functions such as selecting a new message to display or setting a numeric value.

The RDC communicates through use of a Local Area Network (LAN) using a proprietary message protocol defined by MagneTek. This protocol allows messages to be sent to and from the RDC in order to pass display and numeric information (e.g., Armature Current, Line Speed, etc.).

The RDC also allows a Portable Control/Display Unit (PCDU - described in

the MicroTrac DSD Technical Manual) to be plugged into a provided connector. The PCDU allows the viewing of the source of information to be displayed on each RDU. Through use of the PCDU, the items displayed on each RDU can be changed from the default items. The PCDU also has a test mode which has a limited function Hex Monitor which may aid in troubleshooting a system.

The RDC uses a High Impedance Transceiver (HIT) for signal transceiving in order to utilize a bus topology on the LAN.

NOTE

For a full discussion of the LAN, refer to the MicroTrac DSD technical manual, TM 6100.

HARDWARE DESCRIPTION

POWER REQUIREMENTS

The power connector on the RDC is used to supply the RDC with power. In order to select a properly sized power supply, the current (I) requirements of the RDC for each of the voltages must be known. The I requirements are as follows:

- I for +5 VDC = 1300 mA
- I for +15 VDC = 0 mA
- I for -15 VDC = 270 mA
- I for +24 VDC = 0 mA

LAN INTERCONNECT

There are 2 connections which must be made connect the RDC to the LAN.

1. Faston tab J6 must be connected to chassis ground. This is necessary in order to provide a return path for the snubber network of the LAN.
2. Connect J2, a BNC connector, to the LAN coaxial cable. In order to meet LAN requirements, type RG-62/U coaxial cable must be used.

Table 1. RDC/RDU MAX MSGs

RDC 46S02970- EPROM * 97SA-	Maximum Number of RDUs	Maximum Number of MSGs
0020 0280-0004	31	12
0040 0380-0004	4	149
0050 0420-0004	10	54
0060 0800-0004	3	201

* The principle difference between RDC PCBs is the installed EPROM, which establishes the maximum number of RDUs and MSGs.

LAN NODE ADDRESS SWITCHES

The LAN Node address switches allow for the selection of the network ID. The RDC may have a Node address from 100 to 199. Since the Node address is in the hundreds range, the 1 in the hundred's place is assumed, and silk-screened on the PCB as a reminder. There is a rotary switch for each of the other two numeric positions, ten's place (S1) and one's place (S2). These switches must be set before power up, and remain set while powered up, for proper operation. If the switches are changed while powered up, then the LAN Node will get a new network ID; however, the software will not (and cannot) be made aware of the ID change, thus invalid operation will occur.

REMOTE DISPLAY UNIT INTERCONNECT

The RDC communicates with the RDUs through use of an RS-485 bidirectional serial data bus. The RS-485 serial communications take place on differential signal lines, the signal and its inverse. **Each extreme of the serial bus must be terminated with a 120 ohm resistor between the differential lines (for a total of 2 resistors regardless of the number of RDUs).** The terminator will reduce reflections in the signal lines (reflections will cause invalid communication). There are 3 terminals provided on the RDC for connection to the RS-485 bus:

TB1 PIN #	NAME	DESCRIPTION
1	LINE A	This is the RS-485 inverted signal.
2	LINE B	This is the RS-485 non-inverted signal.
3	COMMON	This is the Digital common used for the +5V ground return path. It may be used as a shield connection if so desired.

The maximum length of the RS-485 bidirectional serial data bus, from one extreme to the other, must not exceed 4000 feet. Twisted pair wiring should be used to carry the signals LINE A and LINE B.

PORTABLE CONTROL/DISPLAY UNIT INTERCONNECT

The Portable Control/Display Unit (PCDU) utilized in the MicroTrac DSD system is a custom terminal. The terminal uses a cable with a 6 pin modular plug, RJ-12 type, on both ends. Provision is made on the RDC for connection to a PCDU by use of a modular socket (J5). The modular socket on the RDC provides power to the PCDU and provides the signals necessary to communicate with the PCDU.

LED

There is an LED on the RDC (DS1) that is used to indicate the operating status of the RDC.

OPERATIONAL DESCRIPTION

DEFINITIONS AND ABBREVIATIONS

The definitions of some terms and abbreviations used in this document are as follows:

Active menu item The menu item for an RDU that will be used to get the source of the information to be displayed. When a menu item number is selected, the CDU menu item data will be used; if there is no data in the CDU menu item for the selected menu item number, then the default menu item data is used.

CDU menu item A menu item that was built by using the PCDU.

Default menu A menu that contains the default menu items as received through the LAN from the drives. Each drive connected to the LAN can have default menu items that are to be displayed on

specific RDUs. The default menu items and the order of the menu items are determined by the PAC programmer.

Local RDU When referring to a keyboard, the local RDU is the RDU that the keyboard is connected to.

Locked RDU An RDU whose display may not be modified by a keyboard or push button connected to another RDU.

Menu A list of menu items for an RDU, for which any one may be selected to be displayed on that RDU. See Table 1 for the maximum number of items.

Menu item A source definition of where the information to be displayed, when selected, is to come from. The source definition includes the Drive Node number, the Channel number, and the Subchannel number. The decimal point location is also defined.

Message The data that is displayed on both displays of the RDU. The source of the message is defined in the RDC by a menu item number, Drive number, Channel number, Subchannel number, decimal position, a flag stating what type of message it is (whether the message is modifiable or not), and - if it is modifiable - the minimum and maximum allowable limits of an entered value.

PCDU Portable Control/Display Unit. A device which can plug into an RDC, via a cable with a modular connector (similar to a telephone cord), that has two 16 character alphanumeric displays and a keypad.

RDC Remote Display Controller [LAN Node PCB]. The device that includes the ARCNET LAN Node circuitry and the software to control what is displayed on each RDU. This device also communicates with the drives over the LAN.

RDU Remote Display Unit. The device

that has a 16 character alphanumeric display and a 5-1/2 digit plus sign numeric display.

Selected menu item The menu item number in the RDU's menu that is being displayed.

Unlocked RDU An RDU whose display may be modified by a keypad or push button connected to another RDU. This is the default RDU lock state.

RDC/RDU CONFIGURATIONS

Each RDU in a system may be configured in any of the following ways:

1. RDU alone.
2. RDU and 1 push button. The push button allows the operator to view the drive name, where the data is coming from, and the units of the data in the alphanumeric display of the RDU. All of the unlocked RDUs connected to the same RDC will also show their drive name and units when the push button is pressed. This push button has the same function as the NAME key of the keypad.
3. RDU and 2 push buttons. The first push button allows the operator to view the drive name and units, as described in B, above. The second push button allows the operator to select the next menu item, in the active menu, to display. This push button has the same function as the NEXT key of the keypad.
4. RDU and keypad. The keypad allows the operator the ability to do the same functions as with 2 push buttons, and allows many more functions. These extra functions include showing a message that is not in the RDU's menu, setting a numeric variable, and the ability to control a different RDU, that is connected to the same RDC, as if that RDU were directly connected to the keypad.

5. RDU, keypad, and lockout switch. The keypad allows the operator the same functions as in D, above. The lockout switch will enable or disable the keypad. However, the two keys assigned to the same functions as the 2 push buttons described in B and C, above, (NAME and NEXT) may not be disabled.

NODE/CHANNEL/MENU ITEMS

The PAC language defines a particular RDU displayable message by use of a Node, a Channel, and a Menu Item number. When concerning an RDC, the Node, Channel, and the Menu Item number are defined as follows:

- NODE: RDC LAN Node Address Switch Setting.
- CHANNEL: 1 through 31 for RDU number 1 through 31.
- MENU ITEM #: The RDC keeps a menu in its memory for each RDU. Each menu may have as many as 12 items. Each menu item is referred to by its assigned menu item number.

RDU LOCKOUT

Each RDU can be locked. If an RDU is locked, then a keypad connected to a different RDU may not affect this RDU. However, a push button or keypad connected directly to this RDU may still change the display or set a variable. The RDC assumes that all of the RDUs are unlocked unless specifically told otherwise through a LAN message. The state of being locked is determined by the PAC programmer and will be sent to the RDC via a LAN message.

RDU MESSAGES

In the normal operating mode, each RDU, under control from the RDC, will display an alphanumeric legend and numeric data. The legend may be up to 16 characters in length and is used to describe the data. The numeric data will be limited to 5-1/2 numeric digits plus sign.

The normal operating mode is deviated from by use of a keyboard, a push button, or one of several special events. The messages the RDC will display on the RDU and the special event that caused this are listed and described as follows:

1. “Initializing”. When the RDC is powered up, it makes a checksum calculation of saved parameters and the LAN Node ID, and compares it to a saved checksum. If the checksums are not equal, then the RDC assumes that the memory was never initialized. To show that this condition has occurred, the RDC will display “Initializing” on each RDU until an active menu item is found for the RDU.
2. “No Update” toggling with the legend. This will occur when the RDC has not received a LAN update message from the source of the menu item within the last 5 seconds. The LAN update message contains the most current value to show in the numeric display. “No Update” is used to warn of the possibility of bad data being shown because of the lack of communication.
3. Cursor character toggling with the last character in the legend. The cursor character looks like a block. This indicates that a keypad sequence has started, and has not completed, and that it affects this RDU.

4. **“ERR-MSG CONFLICT”**. This message will be displayed to indicate that more than one drive attempted to assign a menu item to the same menu item number of the same default menu as another drive. For example, Drive A sends a default menu item to RDU 1, menu item 3. Some time later, Drive B sends a default menu item also to RDU 1, menu item 3. When menu item 3 of RDU 1 is selected to be displayed, the RDC will display “ERR-MSG CONFLICT” on the RDU’s display to warn of this error condition. This error condition may be cleared by removing the mistake in the PAC programs and then reinitializing the system. Another way to clear it is to use the PCDDU to create a menu item to override the default menu item which is in conflict.

RDU KEYPAD FUNCTIONS

General

A keypad connected to any RDU may start a keypad sequence. However, once a keypad sequence is started, it must be completed before a keypress from a keypad connected to a different RDU, or any push button input, is recognized.

Up to 60 seconds are allowed between keypresses. If a keypad sequence has started and 60 seconds have elapsed since the last keypress, then the keypad sequence will be aborted. Furthermore, the RDUs will revert to showing the messages that were displayed previous to the start of the sequence.

There is an auto-repeat function on the keypresses. A keypad key will auto-repeat at a rate of 6 presses/second if a key is pressed for more than 0.5 second.

The keypad sequences allow for number modification. On the first press of a digit or a decimal point, the digit display will blank and echo the keypress. Pressing more digits will continue to echo the pressed digit into the least significant location while the previously entered digits are shifted one significant digit to the left. This may continue until the digit limit is reached, and then no further digits will be accepted until the number is entered or the **CLEAR** key is pressed. The entered number will be checked for errors (i.e. number within range, number may be modified, etc.) and then the appropriate action will be taken. If **CLEAR** is pressed, then the number that was displayed prior to the start of the modification will be shown.

The up and down arrows may be used to increment or decrement a number. Pressing the up or down arrow key on an unmodified number will start a number modification key sequence. The sequence may be ended by entering the number or pressing the **CLEAR** key. Pressing the up or down arrow keys after a number has started to be entered will stop the number entry mode and increment or decrement the displayed number. If a digit or a decimal point key are pressed after pressing the up or down arrow keys, then the digit display will blank and echo the keypress once again.

The +/- key may also be used in the number modification process. The function of this key is to change the sign of the displayed number. The actual sign change will not be accepted until the number is entered.

The **CLEAR** key can be pressed to erase mistakes. When a wrong number is entered, **CLEAR** may be pressed to show the original number. If a bad key sequence has been started and not completed, then the **CLEAR** key may be pressed several times to “back out” of the sequence.

Displaying Drive Name and Units

The **NAME** key may be pressed to view the drive name, the source of the data, and the units of the data. These items will be shown in the alpha-numeric display of the RDU. All of the unlocked RDUs connected to the same RDC will also show their drive name and units when the **NAME** key is pressed.

Selecting the Next Menu Item

The **NEXT** key may be pressed to view the next higher numbered menu item in the RDU’s menu. If the highest numbered menu item is currently being displayed, then the lowest numbered menu item will be shown next. Each press of the **NEXT** key will scroll to the next higher numbered menu item.

Selecting a Menu Item Directly

Entering the menu item number followed by pressing the **NEXT** key will show that menu item. If there is no menu item at the entered menu item number, then “ERR-ITEM #” will show in the RDU’s alpha-numeric display, for 1.5 seconds, and then the data that was displayed prior to the start of the modification will be shown.

Modifying Numeric Information

Some data displayed on an RDU may be modified. The desired number may be entered by using any of the previously described keypad number modification key sequences. After the desired number is displayed on the RDU, press the **ENTER** key to enter the number. The entered number will then be compared to the allowable input limits (as programmed in the PAC diagram). If within the limits, then the value will be sent to the drive. If a limit is exceeded, then the exceeded limit will be displayed and an error message will display to state which limit was exceeded. The exceeded limit number can then be entered by pressing the **ENTER** key (and be sent to the drive) or modified as desired followed by pressing the **ENTER** key once again.

Displaying/Temporarily Modifying Source of Display Information

Pressing the **DRIVE** key on the keypad will display the Selected menu item’s menu item data (the source of the displayed information). The alphanumeric display will show the following:

“DWW CXXX SYYY .Z”

where WW = Drive #
XXX = Channel #
YYY = Subchannel #
Z = Decimal position

Any of the displayed fields (Drive #, Channel #, Subchannel #, or decimal position) may be modified by using any of the keyboard number modification sequences. The number to be modified is indicated by a flashing prompt (D, C, S, or .). The number modification progresses from left to right (from D to C to S to .), so if a mistake is made and not noticed until after the number has been entered, then the only way to correct it is to start the whole sequence over again. Pressing the **CLEAR** key before modifying a number field will abort any modifications and return to showing the Selected menu item.

If any of the displayed fields were

modified, then the RDU will show the data defined by the newly entered menu item data. Any modifications made are only temporary and once a new menu item is selected, the modifications will be lost. Note that these modifications are only temporary and do not affect the menu item data stored in memory. In other words, if the menu item is selected again (using the **NEXT** key), then the original menu item data will be used to retrieve and display the data on the RDU.

Selecting Another RDU's Menu

A keypad connected to one RDU may be used to control the display of another RDU. Pressing the **DISPLAY** key on the keypad will allow the selection of the RDU whose display is to be controlled. The alphanumeric display of the RDU that is connected to the keypad will show "DISPLAY XX?", where XX is the last entered RDU display number. The other RDUs connected to the same RDC will then toggle "THIS IS DISP. YY" with their currently displayed alphanumeric information, where YY is the channel number of the RDU. The Display number may then be modified by using the number modification key sequences and then entered by pressing the **ENTER** key. The display of the RDU connected to the keypad will then follow the display of the selected RDU. Any keyboard sequences made now are in reference to the selected RDU's menu, as if the keyboard were directly connected to the selected RDU. Pressing the **CLEAR** key when not in the middle of a key sequence on the selected RDU will return the RDUs to their normal state, and the keypad connection to the selected RDU will terminate.

RDU PUSH BUTTON FUNCTIONS

Each RDU has the capability of getting an input from one of two push buttons, PB1 and PB2. Their given functions are explained in this section.

Displaying Drive Name and Units

PB1 has been defined to react the same way as the **NAME** key of the keypad. The "**NAME**" push button may be pressed to view the drive name, from which the data is coming, and the units of the data. These items will be shown in the alphanumeric display of the RDU. All of the unlocked RDUs connected to the same RDC will also show their drive name and units when the "**NAME**" push button is pressed.

Selecting the Next Menu Item

PB2 has been defined to react the same way as the **NEXT** key of the keypad. The "**NEXT**" push button may be pressed to view the next higher numbered menu item in the RDU's menu. If the highest numbered menu item is currently being displayed, then the lowest numbered menu item will be shown next. Each press of the "**NEXT**" push button will scroll to the next higher numbered menu item.

PORTABLE CONTROL/DISPLAY UNIT FUNCTIONS

The RDC allows a Portable Control/Display Unit (PCDU) to be plugged into a provided connector. The functions that the PCDU may perform when plugged into an RDC are explained in this section.

PCDU Power-Up

When the power is first applied, the PCDU will display a continuously scrolling greeting message and an instruction to "Press HELP". The instruction is there only for the novice or casual user, since any valid function key may be pressed to put the PCDU into the given mode.

Help

Pressing the **HELP** key will give context sensitive help. Pressing **HELP** from the power up greeting message mode will give general help information. Pressing **HELP** while in a mode of operation will give

detailed help information about that mode of operation. Pressing **HELP** while in a help mode will give general help information.

The help information is displayed as scrolling messages on the bottom line of the PCDU. The information is scrolled one sentence at a time. The top line of the PCDU shows some of the keys that may be pressed. Press **INC** or **DEC** to increase or decrease the scrolling rate of the text. Press **<** to go to the start of the sentence. Press **>** to proceed with the text scrolling. Press **ESC** to return the PCDU to normal operation. Press **MON** to view the default lock states and menu items. Press **PRM** to view or modify the active lock states and menu items. Press **TST** to enter a view only hex monitor.

Viewing Default Menu Items and Lock States (MON)

Pressing the **MON** key will put the PCDU into the MON mode. The MON mode is used to view the default lock states and menu items. The default lock states and menu items are those that were received from the drives. These items may not be changed. The top line of the PCDU display will show the following:

“D RDU:XX ITEM:YY”

The “D” on the top line shows that the data being viewed is the Default data. The number following “RDU:” (“XX”) is the selected display number. The number following “ITEM:” (“YY”) is the selected item number.

Item number 0 will show the default lock state (“Locked” or “Unlocked”) for the selected RDU on the bottom line of the PCDU. Item numbers above 0 will show the default menu item data for the selected RDU on the bottom line of the PCDU as follows:

“DWW CXXX SYYY .Z”

where WW = Drive #
XXX = Channel #

YYY = Subchannel #
Z = Decimal position

Menu item data consists of Drive (“D”), Channel (“C”), Subchannel (“S”), and decimal position (“.”). The Drive, Channel, and Subchannel define where the menu item gets its data when selected. The decimal position is the number of digits that will appear to the right of the decimal when displaying the menu item data.

The bottom line will be blank while building a number to make a selection. The bottom line will show “Not in use” when the selected menu item has no data.

The character(s) that are blinking identify the field that will be modified upon a keypress entry. The **INC**, **DEC**, 0 through 9, and **CLR** keys may be used to modify an existing number. The **ENT** or **>** keys will accept the number that was entered and advance to the next field. The **<** key will allow the previous field to be modified. The **ESC** key will abort what is being done and back up one step. The **HELP** key may be pressed to get help about the MON mode.

View/Edit Active Menu Items and Active Lock States (PRM)

Pressing the **PRM** key will put the PCDU into the PRM mode. The PRM mode is used to view or modify the active lock states and menu items. The active lock states and menu items are those that will be used for the displays. The top line of the PCDU display will show the following:

“W RDU:XX ITEM:YY”

The character on the top line (“W”) shows where the data being viewed came from. “D” will appear if the active data is the original default data. “C” will appear if the active data has been entered from the PCDU. The number following “RDU:” (“XX”) is the selected display number. The number following “ITEM:” (“YY”) is the selected item number.

Item number 0 will show the active lock state (“Locked” or “Unlocked”) for the selected RDU on the bottom line of the PCDU. Item numbers above 0 will show the active menu item data for the selected RDU on the bottom line of the PCDU as follows:

“DWW CXXX SYYY .Z”

where WW = Drive #
XXX = Channel #
YYY = Subchannel #
Z = Decimal position

Menu item data consists of Drive (“D”), Channel (“C”), Subchannel (“S”), and decimal position (“.”). The Drive, Channel, and Subchannel define where the menu item gets its data when selected. The decimal position is the number of digits that will appear to the right of the decimal when displaying the menu item data.

The bottom line will be blank while building a number to make a selection. The bottom line will show “Not in use” when the selected menu item has no data. Entering drive “99” into a menu item will make that menu item “Not in use” when selected.

The character(s) that are blinking identify the field that will be modified upon a keypress entry. The **INC**, **DEC**, 0 through 9, and **CLR** keys may be used to modify an existing number. The **INC** and **DEC** keys may be used to toggle between “Locked” and “Unlocked” when modifying the active lock state. The **ENT** or **—>** keys will accept the number that was entered and advance to the next field. The **<—** key will allow the previous field to be modified. The **ESC** key will abort what is being done and back up one step. The **HELP** key may be pressed to get help about the PRM mode.

Hex Monitor (TST)

Pressing the **TST** key will put the PCDU into the TST mode. The TST mode is used to view the data at the given address. The data shown can be either frozen at the time of address entry, or continually updated. The PCDU display will show the following:

“AAAA B CCCCCCCC”
“DDDDDDDDDDDDDDDDDD”

where A = Address, in Hex
B = ASCII character of byte at given address
C = Binary value of byte at given address
D = Hex value of byte at given address and the following 7 Hex byte values

The top line shows the address, the ASCII representation of the byte at the address, and the binary representation of the byte at the address. The bottom line shows the Hex representation of the byte at the address and the 7 bytes that follow it.

The data will be blank while building an address. The **INC**, **DEC**, 0 through 9, A through F, and **CLR** keys may be used to modify the address. The **ENT** or **—>** keys will accept the address that was entered. The **F1** key will toggle from/to continual data updates versus frozen data at time of address entry. The **ESC** key will abort what is being done and back up one step. The **HELP** key may be pressed to get help about the TST mode.

LED STATES

The LED on the RDC is used to indicate the operating status of the RDC.

<u>LED STATE</u>	<u>RDC OPERATING STATUS</u>
On, steady	Power is applied, and the RDC software is executing.
On, blinking	Power is applied, the RDC software is executing, and the RDC is receiving LAN messages.
Off	Power is not applied, or power is applied and the RDC has experienced a fault and has halted execution.