Hardware Manual
9307

Register Access Panel for Cutler-Hammer D50 & D300 PLC

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TABLE OF CONTENTS

Section 1: Introduction

The 9307 Register Access Panel (RAP) allows an operator to access the Timer, Counter, and Word registers within the D50 and D300 processors. The RAP connects directly to the processors programming port, using a communication cable provided with the unit..

Word registers are accessed by entering the numeric address (0 - 255) of the register. Timers and counters are accessed by entering a numeric channel number (0-255). The RAP will retrieve and display the Present Value (PV) or Set Value (SV) that corresponds to the channel entered.

The RAP is designed to operate in two possible modes. These modes are referred to throughout this manual as *Open Mode* and *Protected Mode*. In *Open Mode* all Timer, Counter, and Word registers may be monitored, and modified. Allowing an operator the ability to view and modify all these registers is generally not acceptable within a particular application. *Protected Mode* is designed to allow the system programmer the ability to restrict an operators access to a defined group of registers. In addition to offering access restrictions, *Protected Mode* provides a number of additional useful features that will be discussed within this manual.

To utilize certain *Protected Mode* features, defined registers within the 9307 Processor must be reserved for use by the RAP. Other features are enabled by using a RAP resident setup utility. Setup parameters are safely saved in EEPROM memory located within the RAP.

1.0 Manual Writing Conventions

The RAP has an eight character alphanumeric display window, three discrete LEDs, and sixteen keys. Throughout this manual many references will be made to these entities, therefore, the following conventions have been established.

- Characters that would appear in the eight character display window will be shown in bold print and within quotation marks.

  Example: **"TIM 001"** or **"PV 83.47"**

- Labels that refer to one of the three discrete LEDs will be shown in bold print and always in capital letters.

  Example: **ADDRESS DISPLAY**ED or **KEYBOARD LOCKED**

- Key names will always be shown in bold print inside brackets.

  Example: **[ENT]** or **[LOCK]**

Section 2: Open Mode Access

2.0 Function Key Description

The RAP has sixteen pushbutton keys, ten of which are numeric zero through nine. The remaining six keys have defined functions as outlined below .

The **[LOCK]** key allows the operator to place the RAP into a combination lock mode. This is a *Protected Mode* feature and must be enabled to operate. Refer to Section 3.5 for detailed information on this feature.

The **[DATA]** key is used to toggle the display from address display to data display. If pressed while the unit is displaying Timer or Counter data, it will toggle the display between PV and SV. If pressed while displaying Word Register data, it will toggle the display between integer and hexadecimal.

The **[ADR]** key is used to toggle the display from data display to address display. If pressed while the unit is displaying an address, it will toggle the display between register types, i.e., TIM, CNT, and WORD.

The **[ENT]** key is used to complete the input of an address or data value.

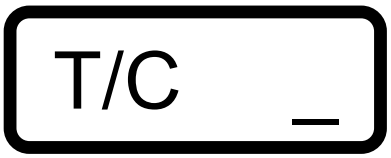
The **[CLR]** key is used to prepare the unit for entry of a new address or data value. It can also reset the entry process if an entry error is made. In protected mode this key is locked out when protected data is displayed. If it is pressed the message **"ACCESS DENIED"** would appear momentarily to indicate the inactive status of the **[CLR]** key.

The **[STA#]** key is used to enter the station address of a particular 9307 processor within a network. This key is enabled or disabled through the RAP's resident setup utility.
Refer to Section 3.6 for detailed information regarding D50 networks.

Section 2: Open Mode Access

When the RAP is first powered up the model number and software version number will be displayed. The display will appear like this: **"D50 V1.0"**.

While displaying the power-up message the RAP is also performing internal diagnostics and attempting to establish communication with the processor. Once communication has been established the following display will appear:



This is referred to as the address entry state. The **ADDRESS DISPLAYED** LED will be lit. The address entry state allows an operator to enter a numeric address for the register to be monitored. Open Mode allows the operator to access any Timer/Counter or Word Register address. In Open Mode no differentiation is made between Timers and Counters, Timer/Counter data will always be shown as an integer value. The operator is responsible for interrupting the data presented.

2.1 Read Data

While in the address entry state the cursor and/or register address will be flashing, indicating an address entry is in process. The **[ADR]** key may be used to toggle between Timer/Counter and Word Register address types. The numeric keys are used to enter the address number. The **[ENT]** key is used to complete an address number entry or an element number entry.

EXAMPLE: Monitor Timer/Counter address T/C 065.

- Press the **[ADR]** key until the counter address entry screen appears. If a counter address already appears, press the **[CLR]** key to prepare for a new entry. Expected screen: **"T/C _"**
- With the cursor flashing press the following keys: **[6] [5] [ENT].**
- The **ADDRESS DISPLAYED** LED will turn off and the **DATA DISPLAYED** LED will light. The display will be showing either the Set Value or Present Value as indicated by the SV/PV designation within the display. To toggle between SV and PV press the **[DATA]** key. The RAP continuously reads the value from the processor, therefore, the data appears in real time.

To monitor a Word Register follow the basic procedure above. Below are some general notes regarding the monitoring of data.

- The valid address range is from 0 to 255. If an address above the maximum is entered the display will momentarily show the message **"OUT OF LIMITS"** then return to display the attempted address. The illegal address will be flashing. To restore the last valid address press the **[ADR]** or **[DATA]** keys, or press **[CLR]** to try another address.
- When Word Register data is displayed the **[DATA]** key can be pressed to toggle between integer or hexadecimal display.
- Displayed integer values range from 0 through 65535. Leading zeros are suppressed.
- Displayed hexadecimal values range from 0000 through FFFF.
- When monitoring data the entire display is used, therefore, the address can not be seen. Pressing the **[ADR]** key will remove the data and show the address. Press the **[DATA]** key to return to data display.

Section 2: Open Mode Access

2.2 Writing Data

Before the RAP can change data within the processor it must first be monitoring the data at the appropriate address. Once this is accomplished, the change is initiated by first pressing the **[CLR]** key. The previous value will be replaced by a flashing cursor. As the desired value is keyed in it will also flash. The process is completed by pressing the **[ENT]** key which will cause the new value to be sent to the Processor.

- The valid data value range is from 0 to 65535. If a value above the maximum is entered the display will momentarily show the message **"OUT OF LIMITS"** then return to display the attempted value. The illegal value will be flashing. To terminate entry mode at this point, press the **[DATA]** or **[ADR]** keys, or press **[CLR]** to try another value.
- An entry may be terminated prior to pressing the **[ENT]** key by **pre**ssing the **[DATA]** key or **[ADR]** key. An entry may be restarted by pressing the **[CLR]** key.
- When entering a new value for a Word Register, the value is entered as an integer even if the previous value was displayed in hexadecimal form.

EXAMPLE: Assume the Set Value of Timer/Counter address 065 is being monitored and the value is to be changed to 1234.

- Press the **[CLR]** key to prepare for entry. The display will show: **"SV _"**, the cursor flashing.
- Press the following keys: **[1] [2] [3] [4] [ENT].** Numbers will flash as they are entered.
- The cursor will disappear and the value will stop flashing. The value has been written.

Section 3: Protected Mode

3.0 Overview

The basic operation described in Section 2, is called the *Open Mode*. It is so named because it allows the RAP virtually unrestricted access to all Timers, Counters, and Word Registers even if they are not used in the processor's application program. This is a powerful feature, but also potentially dangerous. The RAP can also operate in the *Protected Mode* which, as the name implies, allows the system designer the ability to prevent an operator from accessing or modifying defined areas. This is accomplished by providing the RAP with access limit values which are stored in the processor, specifically within predefined Word Registers.

In addition to access limits several other features. listed below, are available in *Protected Mode*.

- If enabled, predefined read and write limits will be enforced. Separate limits are provided for Timer, Counter, and Word Register access. Both upper and lower limits are included.
- If enabled, predefined data value limits will be enforced. Both a high data limit and low data limit are provided.
- Timers and Counters are treated as separate address types. The T/C address designation is replaced with TIM and CNT address types. Timer data will be displayed with a decimal point located in the appropriate position to indicate a 0.1 or 0.01 second time base.
- Set Values and Present Values may be write protected independent of write limit values.
- Offset addressing mode allows reassignment of Processor addresses to make operator interaction easier.
- A five digit combination lock may be enabled to allow access only to selected personnel.
- The Processor can lock the keypad suspending all operator interaction.
- The Processor can force the RAP to monitor an address at power up, or at any time with no interaction from the operator.
- The Processor can interrupt normal RAP operation to display a defined alphanumeric message.
- The RAP can access any Processor within a D50 network. Each processor holds it own set of limits, and Protected Mode parameters.

With the exception of Offset addressing, all the *Protected Mode* functions are dynamic by design, that is, they may be independently enabled or disabled at any time by the Processor's application program.

To utilize the *Protected mode* functions several Registers must be reserved within the Processor for use with the RAP. Two separate processor memory areas are utilized by the RAP. Auxiliary Internal Relays M3100 through M3115 must always be reserved for RAP use. This group of 16 coils is referred to as the *Command Register*. Word Registers W242 through W255 are reserved as determined by the *Protected Mode* functions enabled. This group of registers is referred to as the *Dialogue File*.

Section 3: Protected Mode

3.1 Read and Write Limits

In most applications it is necessary to limit an operators access into the Processor's memory. This is accomplished by specifying the highest and lowest address that an operator can access within a particular address type, i.e., Timer, Counter, and, Word Register. The RAP will not allow access to any address outside those limits. The highest and lowest data value that may be written can also be specified to further restrict an operators privilege.

- The RAP will enforce read and write limits only when enabled to do so.
- When limits are enabled they will be enforced on all address types.
- The read and write limits for each address type will be defined within the Processor's Word Register memory.
- There are no illegal limit values. Read and write limit values may be set to any value. Read limits may be defined outside of the write limits, so that some elements are read only. An address can not be written to unless it can first be read, i.e., it is not possible to have write only addresses.
- Limits may be enabled, disabled, or changed during run time under application program control.

Read / Write Limit Example:

The addresses form a contiguous block. The following is a graphic representation of how access limits would appear. This example places the following limits on Word Registers.

High Read Limit = 010, Low Read Limit = 002, High Write Limit = 010, Low Write Limit = 006

Shaded areas are protected.

W255	
:	
:	
W012	
W011	
W010	Read & Write
W009	
W008	
W007	
W006	
W005	Read Only
W004	
W003	
W002	
W001	
W000	

Section 3: Protected Mode

3.2 Dialogue File

To utilize many of the Protected Mode features a group of Word Registers must be reserved within the 9307 Processor for use with the RAP. This group of Registers is referred to as the *Dialogue File* and provides a means by which data can be exchanged between the RAP and Processor. The various parameters within the *Dialogue File* are always located at a specific address, therefore, the RAP always knows where to find them.

The *Dialogue File* is structured as shown here:

ADDRESS	FUNCTION
W255	Combination
W254	Forced Address type and number
W253	Timer Write Limits
W252	Timer Read Limits
W251	Counter Write Limits
W250	Counter Read Limits
W249	Word Register Write Limits
W248	Word Register Read Limits
W247	Data Value High Limit
W246	Data Value Low Limit
W245	Counter SV Reassignment
W244	Timer SV Reassignment
W243	Display 7 / Display 8
W242	Display 5 / Display 6
W241	Display 3 / Display 4
W240	Display 1 / Display 2
W239	Current Address Viewed

The high and low limit values for Timer, Counter, and Word Registers are stored within a single word. Within a single Word Register the high limit is stored in the high byte of the register while the low limit is stored in the low byte. For example: suppose the Timer high read limit desired is 25 and the low limit desired is five. The integer value stored in Word Register W252 would be 6405. There are two ways to explain the resulting value stored in W252.

✓ using hexadecimal.....

The desired limit values can be converted to their hexadecimal equivalents then the values stored as high byte, low byte within the appropriate Word Register.

25 = 19 hex, 5 = 05 hex, value in W252 is then: 1905 hex.

✓ using the integer values....

The high limit value must be multiplied by 256 then the result added to the low limit value.

25 x 256 = 6400, 6400 + 5 = 6405, value in W252 is then: 6405

Section 3: Protected Mode

3.3 Command Register

The *Command Register* is viewed by the RAP as sixteen individual coils. The individual coils enable certain functions, instruct the RAP to perform a specific function, or indicate the status of a function. The RAP will monitor and update the *Command Register* frequently, so each of the coils may be changed by the Processor's application program at any time.

The *Command Register* is structured as shown here:

ADDRESS	FUNCTION
M3100	Protected Mode
M3101	SV Reassignment
M3102	Lock RAP
M3103	Enable Combination Lock
M3104	Combination Lock Status
M3105	Invalid Combination Entered / Power up
M3106	Forced Address
M3107	Display Message
M3108	Disable Word Register Access
M3109	Disable Counter Access
M3110	Disable Timer Access
M3111	Enable Read/Write Limits
M3112	Enable Data Limits
M3113	Limit Update
M3114	Set Value is Read Only
M3115	Present Value is Read Only

3.3.1 Protected Mode (M3100)

This coil determines if the RAP will operate in *Open Mode* of *Protected Mode*. When M3104 is energized the RAP will operate in Protected Mode. This coil must not be changed during run time or unexpected RAP operation may result.

3.3.2 SV Reassignment (M3101)

Refer to Section 3.6 for information regarding this coil.

3.3.3 Lock RAP (M3102)

The Lock RAP feature allows the RAP to be completely disabled by the Processor's application program. When this coil is energized the **KEYBOARD LOCKED** LED will light and the keypad will be ignored. The display will remain operational. If monitoring data, it will continue to monitor that data. It will also continue to monitor the *Command Register* and perform any function that is requested, including the *Display Message* and *Display Forced Address*.

When the coil is de-energized, the **KEYBOARD LOCKED** LED will turn off and normal keypad operation will resume.

Section 3: Protected Mode

3.3.4 Combination Lock Coils (M3103, M3104, M3105)

Section 3.5 describes the use and setup for the Combination Lock feature. Refer to that section for information regarding these *Command Register* coils. Coil M3105 has a secondary function. When the RAP is first powered this coil will be energized then de-energized. It may be used to trigger features such as forced address display or message display. When used as a power up indication, it should be programmed in series with a normally closed M3104 contact. This will prevent false power up indications when also using the Combination Lock feature.

3.3.5 Forced Address (M3106)

The *Forced Address* feature allows the RAP to be forced to a specified address by the Processor's application program. This is accomplished by first storing the address type and address number to be displayed in the *Dialogue File*, then energizing M3106. When M3106 is energized the RAP will halt normal operation, display the specified address for a moment, then begin displaying the data at that address. If the specified address is a Timer or Counter, the Set Value or Present Value can be selected. If the specified address is a Word Register the data display format can be selected.

The value stored at W254 is a summation of the address number, address type, and data format values. Use the following formula to determine the value to be stored at W254.

Formula: ***Stored value = Register Address + Register Type value + Data Format value***

Register Type values: Word Register = 256, Counter = 512, Timer = 1024
Data Format value: PV display / HEX display = 32768, SV display / Integer display = 0

Example: Force the RAP to display the Present Value of Timer 50.
Register Address = 50, Register Type = 1024, PV display = 32768

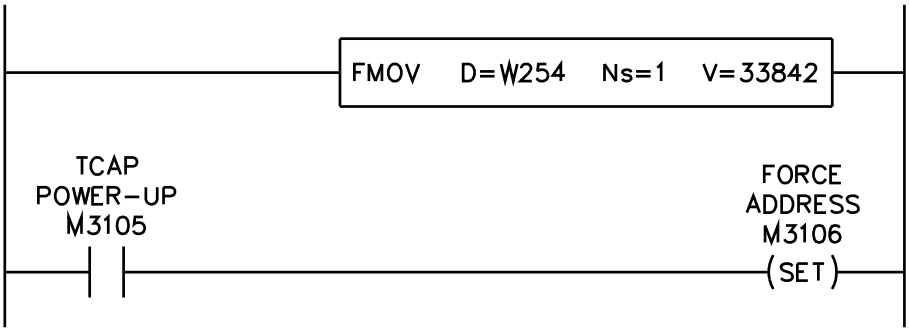
Stored Value = 50 + 1024 + 32768 = 33842

- The forced address may be any Timer, Counter, or Word Register from 0 through 255.
- Read and write limits are ignored. Data value limits will be enforced if enabled.
- If M3106 is held energized, the operator can not change to any other address, The operator can view the address by pressing the **[ADR]** key and toggle between Set Value and Present Value or Integer and hexadecimal display by pressing the **[DATA]** key.
- If M3106 is de-energized the RAP will continue to monitor the specified address until the unit is instructed to perform another function either by an operator or by the Processor.
- The address stored in the *Dialogue File* must be the actual address used within the Processor's application program. If offset addressing is enabled the RAP will display the offset address not the actual address used to force the display.

Section 3: Protected Mode

Application Note:

Using the Forced Address coil (M3106) and the RAP Power-up coil (M3105) the RAP can be forced to a predefined address each time the RAP is first powered up. To force the RAP to display the Present value of Timer fifty on power-up the following ladder logic is required.



Using a SET coil allows the RAP to reset it after the force procedure is completed.

3.3.6 Display Message (M3107)

The *Display Message* feature allows a predefined alphanumeric message to be forced onto the RAP display. The message to be displayed must be stored in Word Registers W240 through W243 of the *Dialogue File* as ASCII characters. When Coil M3107 is energized the RAP will stop what it is doing and display the message. As long as the coil remains energized, the message will remain on the display. When M3107 is de-energized, the RAP will return to its prior state.

- The *Display Message* feature has a higher priority than any other display feature, including *Forced Address* and *Combination Lock*. The Lock RAP feature will function simultaneously with this feature
- While M3107 is energized only the **[CLR]** key will be active. The **KEYBOARD LOCKED** LED will be flashing. When the **[CLR]** key is pressed the RAP will attempt to reset coil M3107. If the application is holding M3107 energized the message will remain.
- The RAP will read the ASCII data from the *Dialogue File* and update the display frequently. By modifying the data in the *Dialogue File* the message may be scrolled or flashed.
- The message may consist of any characters with ASCII codes from 20 hex to 5A hex. This includes most common ASCII symbols, all numbers, and all capital letters. The display does not support lower case letters. Any character that is not supported will produce a blank character.

EXAMPLE: To display **"TEST MSG"** the following values must be stored in the *Dialogue File* as indicated. Coil M3107 in the *Command Register* must be energized.

ADDRESS	FUNCTION	ASCII	HEXADECIMAL	INTEGER
W240	Character 1 & Character 2	TE	5445	21573
W241	Character 3 & Character 4	ST	5354	21332
W242	Character 5 & Character 6	M	204D	8269
W243	Character 7 & Character 8	SG	5347	21319

Section 3: Protected Mode

3.3.7 Disable Access (M3108, M3109, M3110)

These three coils determine which address types the RAP may access. If the coil is energized the associated address type may not be accessed, in fact, the RAP will not offer that type as an option.
If M3108, M3109, and M3110 are all energized when the RAP is powered the message **"DISABLED"** will be displayed and all RAP communication will halt. If these three coils are all energized during run time the RAP will display the message **"FAILSAFE"**. Complete access to particular address types may be enabled or disabled at any time under application program control.

3.3.8 Enable Read/Write Limits (M3111)

With coil M3111 de-energized the operator may enter any address value between zero and 255. The *Enable Read/Write Limits* feature allows a high and low limit to be established for each address type. When the coil M3111 is energized the RAP will only allow access to addresses that fall within the specified range for each address type. The limit values must be stored in the *Dialogue File* as shown in Section 3.2.

3.3.9 Enable Data Limits (M3112)

With coil M3112 de-energized the operator may enter any data value between zero and 65,535. The *Enable Data Limits* feature allows a high and low limit to be established for applications that require special restrictions. When coil M3112 is energized the RAP will write only values that fall within the established limits. The limit values must be stored in the *Dialogue File* as shown in Section 3.2.

3.3.10 Limit Update (M3113)

On power up the RAP will read the contents of the *Dialogue File*. If *Protected Mode* features that use the *Dialogue File* are to be enabled then valid data must be stored prior to powering the RAP. The Limit Update coil allows the application program to force the RAP to read the *Dialogue File* upon command. This allows limit values to be changed as often as necessary.

Recommended ladder logic for triggering a limit update

When M3113 is energized the RAP will read *Dialogue File* registers W246 through W253 and W255, then store their values internally. The RAP will then attempt to de-energize the coil. If the ladder logic does not allow the coil to be de-energized the RAP will continue to re-read the *Dialogue File*. This will essentially cause normal operation of the RAP to cease. When a limit update is executed RAP will be forced to the address entry state.

3.3.11 Read Only (M3114 & M3115)

The SV Read Only (M3114) and PV Read Only (M3115) coils allow the application program to prevent data modification without regard to limits. If M3114 is energized then Set Values for both Timer and Counters may not be changed. If M3115 is energized then Present Values for both Timer and Counters may not be changed. These coils are monitored continuously, therefore, changing their status during run time will affect the operation of the RAP.

Section 3: Protected Mode

3.4 Offset Addressing

Offset addressing is a form of indirect addressing, that is, the address entered by the operator is not the actual address the RAP will access. This feature is especially useful with Timers and Counters since they share a common address area. By using offset addressing Timer addresses can start at TIM000 and Counter addresses can start at CNT000. The two addresses would actually access unique addresses within the Processor.

Offset Addressing is enabled through the resident Setup Utility in the RAP. Refer to Section 3.6 for detailed information. In addition, address Read/Write limits must be present in the Dialogue File even if Read/Write Limits are not enabled. The Low Read Limit is used as the beginning address for a particular address type. For example: if the Low Read Limit for Timers was set at 25 then TIM025 would actually be accessed when the operator entered the address TIM000 into the RAP. When Offset addressing is enabled it is active for all address types.

Below is a graphic representation of Offset Addressing:

Assume the following Read/Write Limit values are in effect, M3111 is energized.....

ADDRESS	FUNCTION	INTEGER	HEXADECIMAL
W252	Timer Read Limits	6144	1800
W250	Counter Read Limits	16690	4132
W248	Word Register Read Limits	51330	C864

Write limits have been omitted since they are beyond the scope of this application.

T/C255	
:	
:	
:	
:	
:	
:	
:	
T/C066	
T/C065	CNT015
:	:
T/C050	CNT000
T/C049	
:	
T/C025	
T/C024	TIM024
:	:
T/C000	TIM000

W255	
:	
W201	
W200	W100
:	:
W100	W000
W099	
:	
:	
:	
:	
:	
:	
:	
:	
:	
:	
W000	

Access is not allowed within shaded areas.

Section 3: Protected Mode

3.5 Combination Lock

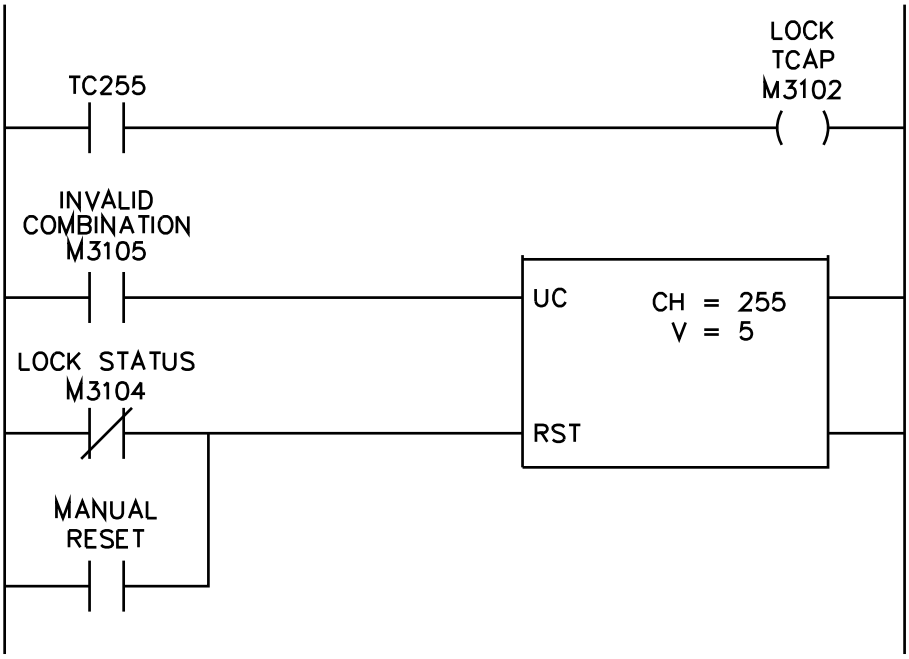
A Combination Lock can be applied to block all unauthorized access to the RAP. Only those operators that know the 5-digit combination will be allowed access. To enable the combination lock feature a combination must be stored in the *Dialogue File* (W255) and the Enable Combination Lock coil (M3103) must be energized. The combination may be any value from zero through 65,535.

If the Combination Lock is enabled, the combination lock will be applied at power up. After displaying the RAP version number, the display will show "**COM LOCK**". To unlock the RAP, the operator must key in the 5-digit combination then press **[ENT]**. Combination entry is blind, i.e., numbers are not displayed as they are keyed in. The operator must always enter five digits, e.g., if the combination were 100, the operator must key in **[0] [0] [1] [0] [0] [ENT]** for the value to be accepted. Once the RAP is unlocked, it may again be locked by pressing the **[LOCK]** key.

Two additional coils in the *Command Register* are associated with the Combination Lock feature. Coil M3105, Invalid Combination Entered, is energized for approximately one second by the RAP any time an incorrect combination is entered. At the same time the message **"INVALID"** will be displayed.

Coil M3104, Combination Lock Status, is energized by the RAP any time the Combination Lock is activated. when the correct combination is entered the RAP will de-energize this coil.

Application Note:



Counter 255 is incremented each time an invalid combination is entered. If five consecutive invalid combinations are entered the counter will energize its output which will energize the Lock RAP coil (M3102) in the *Command Register*. At that point the keypad will remain locked, preventing any further combination entries, until a manual reset occurs.

Section 3: Protected Mode

3.6 Set Value Reassignment

Each Timer and Counter is comprised of four components, which include a Channel number, a programmed Set Value, a Set Value Word Register, and a Present Value Word Register. During the power up cycle of the Processor the programmed Set Value is loaded into the Set Value Word Register. Also, if the Processor is switched from STOP to RUN the programmed Set Value will again be loaded into the Set Value Word Register.

The RAP reads from and writes to the Set Value Word Register, therefore, changes are not permanent. To make Set Values changes permanent, the program must be amended using a programming device.

A feature has been incorporated into the RAP to allow up to sixteen Timers and/or Counters to have retentive Set Values without modifying the application program. This is accomplished by using the retentive KEEP Relay registers within the Processor. This procedure is referred to as Set Value Reassignment.

This is how it works.....

First decide how many Timers and Counters need retentive Set Values. Remember, only sixteen total Timers and/or Counters may be retentive since only sixteen KEEP Relay registers are available. The sixteen retentive registers may be assigned in any combination. Below are a few examples to better describe what this means.

- Eight Timers and eight Counters
- Three Timers and Two Counters
- Twelve Timers and Four Counters
- Sixteen Timers and zero Counters

Once the quantities have been determined, this information must be made available to the RAP. Two Word Registers within the *Dialogue File* are reserved for this purpose. Word Register W244 describes the Timer reassignments while Word Register W245 describes the Counter reassignments.

Example: The following example describes what data is stored in Word Registers W244 and W245 for a given assignment.

Assume: Five retentive Timers are required, TIM050 through TIM054.
Two retentive Counters are required, CNT100 and CNT101.

The RAP views W244 and W245 as having a low byte and high byte. The low byte indicates the starting Timer/Counter channel number while the high byte indicates the quantity of Timers or Counters that are affected. For this example, W244 and W245 would hold the following values:

	High Byte	Low Byte
Word Register W244	Timer Quantity = 5	Starting TIM Channel = 50
Word Register W245	Counter Quantity = 2	Starting CNT Channel = 100

There are two ways to convert the high byte, low byte information into a single value that can be written to the Word Registers.

✓ using hexadecimal.....

The desired assignment values can be converted to their hexadecimal equivalents, combined, then stored in the appropriate Word Register.

5 = 5 hex, 50 = 32 hex, value in W244 is then: 0532 hex.

✓ using the integer values....

Section 3: Protected Mode

The quantity must be multiplied by 256 then the result added to the Channel number.

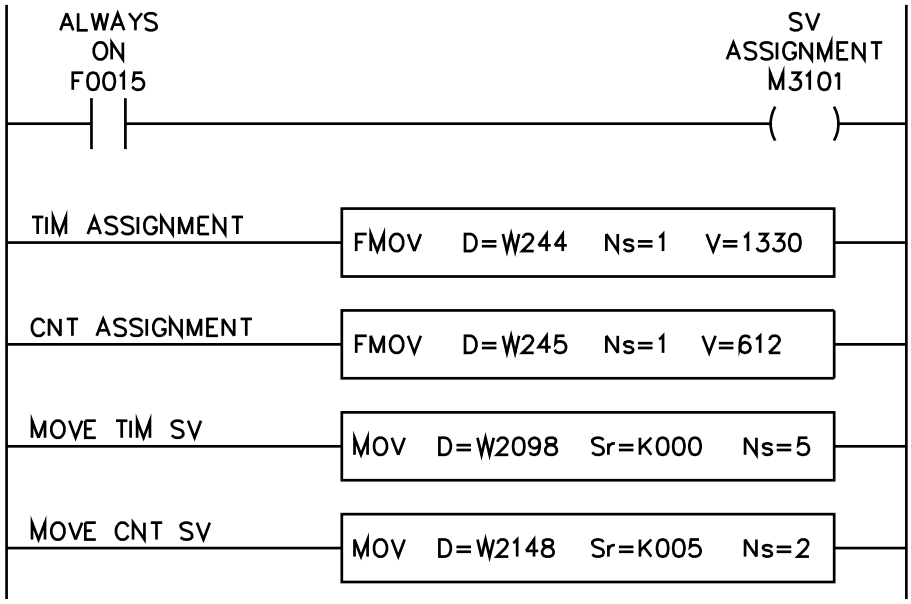
2 x 256 = 512, 512 + 100 = 612, value in W245 is then: 612

Based on this information the RAP will allocate KEEP Relay Registers starting with K000. The reassignments for this example are shown in the table below.

	Normal SV Address	Assigned SV Address
TIM050	W2098	K000
TIM051	W2099	K001
TIM052	W2100	K002
TIM053	W2101	K003
TIM054	W2102	K004
CNT100	W2148	K005
CNT101	W2149	K006

KEEP Relay Registers are assigned starting with K000. Timers are always assigned first. KEEP Relays that are not assigned may be used for other purposes.

To implement the reassignment feature, the following five lines of ladder logic are required.



The first line indicates to the RAP that the reassignment feature is activated. The next two lines move the reassignment values into the *Dialogue File*. The last two lines move the assigned retentive registers to the Set Value Word Registers. The RAP must also be in *Protected Mode.*

Section 3: Protected Mode

3.7 Current Address Monitored

When operating in Protected Mode the RAP indicates to the Processor the address number and address type it is currently monitoring. If the address is a timer or counter the RAP will also indicate if the Set Value or Present Value is displayed. The RAP accomplishes this by writing a coded value to Word Register W239. The low byte of the word is the address number from zero to 255. The high byte indicates address type by controlling four bits.

This feature may be used to trigger a momentary message on the RAP or change limit values when certain registers are accessed.

Word Address W239

High Byte								Low Byte
---	---	PV	---	---	TMR	CNT	W	---------- ADDRESS ----------

Note: PV = SET (1): Present Value displayed. PV = CLR (0): Set Value displayed.

Section 3: Protected Mode

3.8 Setup Utility

The RAP includes a resident Setup Utility which allows several operating parameters to be selected. The selected parameters are saved in EEPROM which maintains them securely but allows them to be easily changed by the system programmer. The parameters that may be set are listed below.

Processor Station number
[STA#] key Enable/Disable
Offset Addressing Enable/Disable

To enter setup mode hold down the **[ENT]** key while applying power to the unit. The key must be held until the display shows the message **"PICKTEST"**. Press the **[0]** key to enter setup. The display will show the message **"SETUP..."** for a moment then display the current Processor station number.

The station number display will look like this: **"PLC# 000"**

To enter a new station number simply press the number keys until the desired number appears in the display window, then press the **[ENT]** key to save the new number in EEPROM memory.

If the **[STA#]** key is disabled, the RAP will ignore the station number saved in EEPROM and use the value 255. The value 255 will allow communication with any 9307 Processor regardless of the station programmed into the Processor.

When the **[ENT]** key is pressed the unit will automatically go to the next parameter which is **[STA#]** key enable..

The enable station key display will look like this: **"STAKEY N"**

Use the **[DATA]** key to toggle between Yes and No. When the desired choice is shown, press the **[ENT]** key to save it in EEPROM memory. The unit will then go to the last parameter which is offset addressing enable.

The Offset addressing enable screen looks like this: **"OFFSET N"**

Use the **[DATA]** key to toggle between Yes and No. When the desired choice is shown, press the **[ENT]** key to save it in EEPROM memory. The unit will now review the values stored in the EEPROM memory, calculating a checksum based on these values and save it in EEPROM memory also.

The display will show the message **"SETUP..."** for a moment then display the Processor station number. At this point the unit may be re-powered to begin normal operation using the new parameters entered or you can remain in setup mode and review the stored parameters. To review the saved parameters press the **[ADR]** key. The **[ADR]** key will index from one parameter to the next without modification.

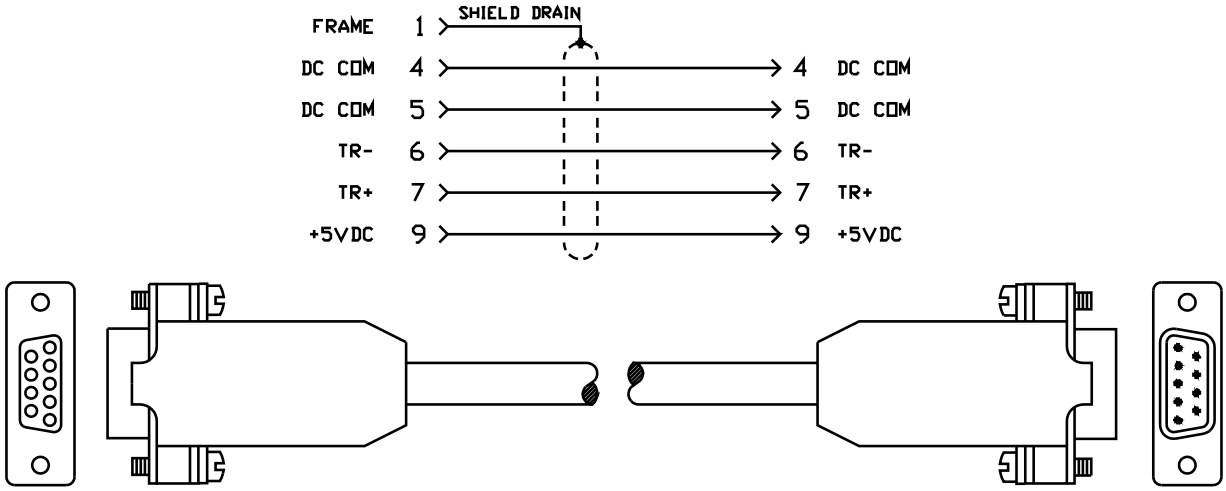
Section 4: Communications

4.0 Single Processor Communication

The RAP communicates with the D50 Processor asynchronously using a secure protocol. The physical connection between the RAP and Processor uses RS-485 Signal levels in a half duplex configuration. The RAP may be connected to a single Processor using the ten foot communication cable included. In this one to one configuration the supply power for the RAP is provided by the Processor through the communication cable. Both the Processor and RAP utilize a nine pin subminiature D-type connector for communications.

Since the Processor and RAP use RS-485 as the physical interface, they may be located at distances far greater then ten feet, however, to do this the RAP must be provided with a supply power source other then the Processor. A regulated DC power supply capability of providing five volts with a minimum 200 milliampere capacity is necessary.

RAP to Processor Communication Cable



4.1 9307 Communication Network

The RAP supports the D50 communication network. This network is a single master, multiple slave network utilizing bi-directional RS-485 signals. The network will support 32 devices. RS-485 networks are wired in a point to point fashion, i.e., one after another forming a single trunk line. Drop lines off the trunk line are not recommended. The network should be wired with RS-485 grade twisted-pair communication cable such as belden 9842. It is also recommended that each end of the network be terminated with a resistance of approximately 120 ohms.

If the RAP is the master device within the network it may be physically located anywhere within the network. Station numbers assigned to individual devices on the network do not necessarily relate to the physical position of the device within the network. The **[STA#]** key on the RAP is used to select which Processor it will communicate with. When a new station number is selected the RAP will display the message **"LINKING"** while it attempts to establish communications with the selected Processor. If unsuccessful it will display the message **"--FAIL--"** for a moment then return to the station number display showing the last valid station address. When the RAP is successful in establishing communications with the new Processor, it is as though the RAP had just been powered. This means the new Processor will control all protected mode functions and provide all function values,. e.g., limits, combination, etc..

Appendices:

Appendix A: Error Codes

The RAP will display one of the following error codes if it encounters a configuration, communication, or hardware error that it cannot recover from without help from an operator. After taking appropriate action to correct the error, press the **[CLR]** key to restart, or re-power.

Display	Possible Cause
RAM ERR	Supply voltage problem, electrical noise, or hardware failure
ROM ERR	
CHECKSUM	
COM ERR	Wrong station address, comm. cable, noise, hardware failure
DISABLED	All address types disabled by *Command Register* during power-up.
SV ERROR	Illegal value using Set Value Reassignment (Section 3.6)
FAILSAFE	All address types disabled during run time, electrical noise.

The following messages may be displayed in response to certain keystrokes. These are not fatal errors. The error message will be displayed for a few seconds then the RAP will continue to operate.

Display	Possible Cause
ACCESS DENIED	Current value displayed is write protected
OUT OF LIMITS	Address entered is not within assigned limits
FA ERROR	Forced address value (W254) is invalid

The following messages will be displayed in response to status information received from the Processor. The message will be displayed until the status changes.

Display	Possible Cause
PLC STOP	The Processor is in STOP mode
PLC Fail	The Processor is reporting an internal error

Appendix B: Installation

The RAP is designed to be mounted in the door of an enclosure or on an operators console. During installation care must be taken to protect the unit from metal chips and conductive particles. Failure to protect the unit may cause damage when power is applied.

Electrical Requirements

If power to the RAP is provided by an external power supply instead of the 9307 Processor, the supply must meeting the following requirements.

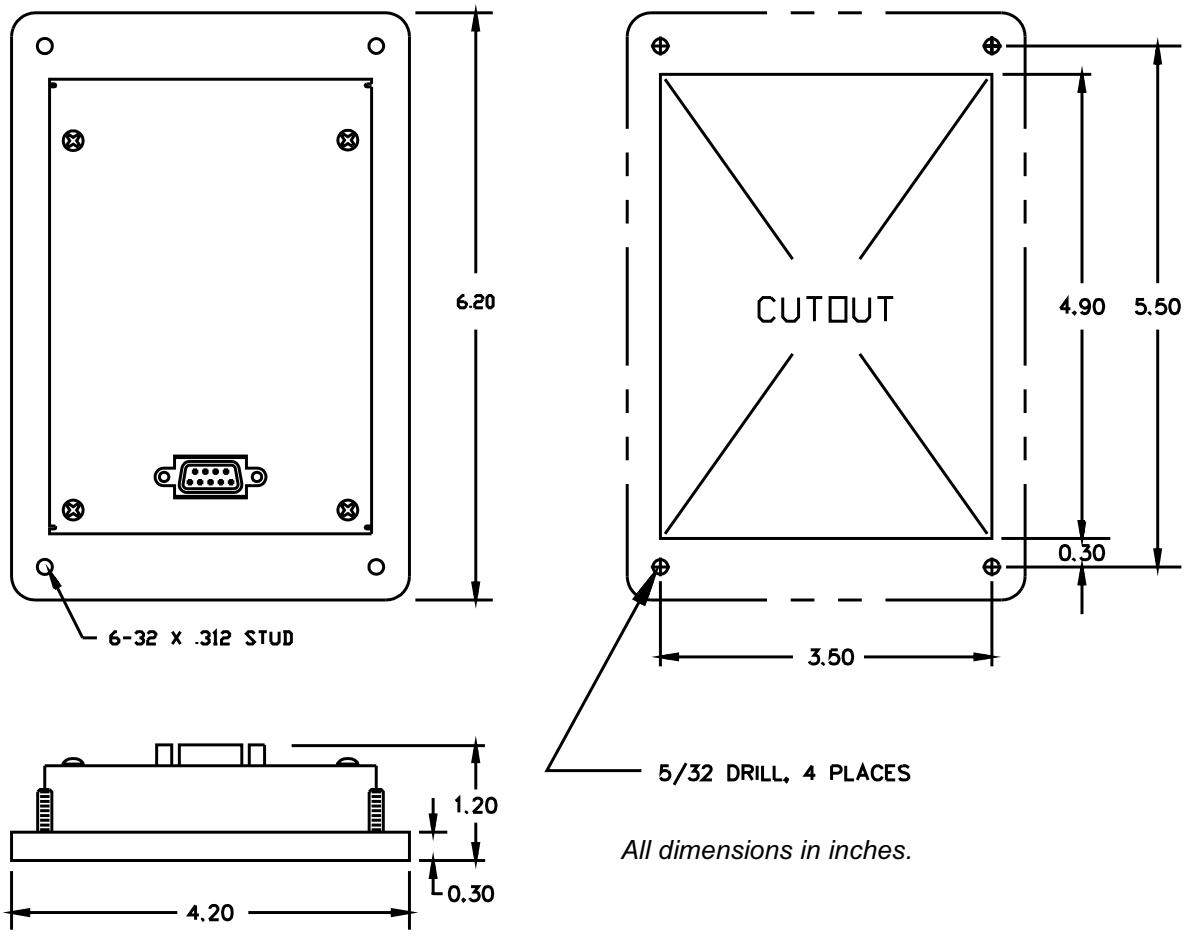
Appendices:

Output voltage: 5.0 VDC ±5% @ 50 mV maximum ripple.
Output current: 200 milliampere.

Wiring Considerations

Care must be taken when routing the communication cable since it includes the 5 VDC supply wiring. The communication cable must be keep away from AC lines and sources of high energy fields such as arc welders, motors, starters, servo controllers, generators, induction heaters, and transformers. If the cable must cross AC lines it should cross perpendicular to the AC line.

Mounting Dimensions



All dimensions in inches.