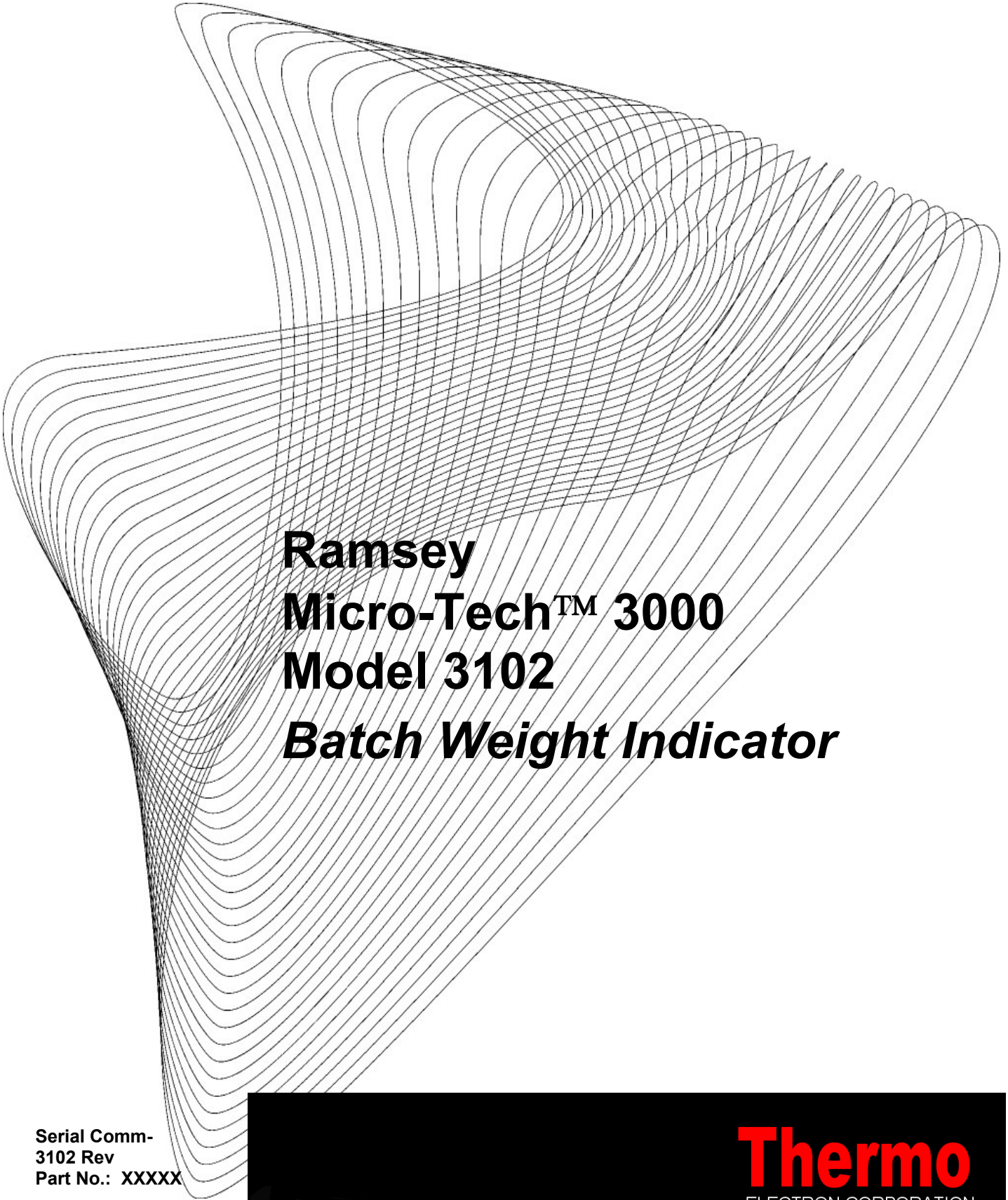
Serial Communications Manual



Ramsey
Micro-Tech™ 3000
Model 3102
Batch Weight Indicator

Serial Comm-
3102 Rev
Part No.: XXXXX

Thermo
ELECTRON CORPORATION

Ramsey
Micro-Tech ™ 3000
Serial Communications
Model 3102
Batch Weight Indicator

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Revision History

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Chapter 1 Introduction

1.1 General

The Micro-Tech 3000 Integrator is a bus-based microprocessor instrument equipped with one COMM A (on Mother Board) that can be equipped (optionally) with a second serial communication boards. Each COMM A board has one serial channel that can be configured according to the following standards.

- RS423/RS232C — For point to point asynchronous bidirectional communications, maximum 50 feet (15 m). Modem capability.
- RS485/RS422 — For point to point or multidrop 4 wire bidirectional communications, maximum 4000 feet (1200 m).
- Current Loop — For high immunity bidirectional asynchronous communications. Passive only.

All of the above are optically isolated.

COMM A board (Optionally) can be installed in any available mother board expansion slot. After installing the board and power has been restored, the instrument automatically detects the new board and adds the communication set-up scrolls to the Main Menu scrolls. The Micro-Tech refers to the COMM A on the Mother Board as COM 1, and the COMM A board (if installed) as COM 2.

If two COMM A are availables; one can be set up for printing, the other one for transferring data to and from other intelligent devices such as computers and PLC's. The system cannot support two printers or two COMM lines.

Each COMM A contains a perpetual clock/calendar circuit with battery backup. The battery is located on the mother board and is the same battery used for system memory backup. The system automatically detects and uses the clock calendar circuit of the first board and ignores the second.

Time and date set-up screens become visible after the COMM board is installed.

The Micro-Tech 3000 Integrator COMM meets the year 2000 requirements.

1.2 Communication Protocols

When a COMM line is set up for communication (not for a printer), the system is able to send and receive data to and from another device connected to the COMM line. The COMM option comes with the following software communication protocols already built in:

- PC-Master — A Thermo Ramsey proprietary protocol, multidrop.
- Modbus — An AEG proprietary protocol, multidrop. The COMM option only contains a subset of the protocol as specified in this manual.
- Allen-Bradley — A proprietary protocol, multidrop. The COMM option only contains a subset of the protocol in the PLC-5 version of it, as specified in this manual.

- 3964R A Siemens proprietary protocol, single point.

The hardware can be configured (through jumpers on the Mother Board and on the optinally COMM board if available) to one of the three standards as listed in the previous paragraph. However, only the RS485/RS422 standard allows multidrop communications, RS232C and Current Loop can only be used in point to point mode. This does not prevent the use of a protocol; it only prevents physically connecting the Micro-Tech 3000 to more than one device.

CAUTION

The communication protocols have been implemented and tested as described in this document or in other referenced documents. It is the intention of Thermo Ramsey to provide all the necessary information and help the user to connect the instrument to other compatible devices. However, because most of the protocols are specific to other manufacturers, Thermo Ramsey declines any responsibility for any malfunction that may occur when connecting the instrument to devices of other manufacturers, unless tested and approved by Thermo Ramsey.

1.2.1 Protocol Rules

The communication protocol allows a remote intelligent device to read and eventually write information from and to the Micro-Tech 3000. For convenience, the information is organized in a set of registers as listed in this document.

During the communication activity, the Micro-Tech 3000 always acts as Slave, meaning it responds to a request from a Master device on the line, but never attempts to send messages out.

The following rules apply:

a. The Micro-Tech 3000 responds only if the message is completely received.

b. The Micro-Tech 3000 reads the message and looks for the address, which is contained into an address byte in the query package. The message is then processed only if the address matches the one specified in the set-up data of the Micro-Tech 3000, otherwise it is ignored.

c. When the system receives a message, the integrity of the message is checked. An answer-back message is prepared if the message is formally correct.

d. When a message containing a variable to be written in memory is received, the system checks the correctness of the message and, if it is correct, immediately sends the answer-back message. This does not always mean the data is written in memory. The system first checks the register number (which must correspond to a valid address of a variable), then the minimum and maximum limits, and then the password. If data can be accepted, it is stored in memory and the success flag is set to 0 (no error). If not, it is set to 1. To know if the last variables sent have been stored, the Master checks (reads) the success flag contained in a read only register.

The following procedure applies:

- The Host sends data to the Micro-Tech 3000.
- The Host waits at least 100 ms.
- The Host reads the success flag. It should be 0.

Some data is read only, some is read write, and some is write only.

WARNING

In all cases, the maximum number of words the system can transfer is limited to 41 per time. Requests of registers in excess of 41 are considered errors and do not generate an answer.

1.3 Printer

When a COMM line is set up for printing, the system prints out data in different ways, depending on the set-up. Print menus become visible that allow the user to define when and in which format the data is printed.

1. Periodical printouts at predefined intervals, as well as at predefined times of day, or on command is possible.

2. The format of the printouts is selectable between a number of predefined formats, plus a fully programmable user defined format. In this particular case, the user is able to easily format the printout to fit into any pre-printed ticket or form, without the need of special software.

1.4 Thermo Electron Warranty

The seller agrees, represents, and warrants that the equipment delivered hereunder shall be free from defects in material and workmanship. Such warranty shall not apply to accessories, parts, or material purchased by the seller unless they are manufactured pursuant to seller's design, but shall apply to the workmanship incorporated in the installation of such items in the complete equipment. To the extent purchased parts or accessories are covered by the manufacturer's warranty, seller shall extend such warranty to buyer.

Seller's obligation under said warranty is conditioned upon the return of the defective equipment, transportation charges prepaid, to the seller's factory in Minneapolis, Minnesota, and the submission of reasonable proof to seller prior to return of the equipment that the defect is due to a matter embraced within seller's warranty hereunder. Any such defect in material and workmanship shall be presented to seller as soon as such alleged errors or defects are discovered by purchaser and seller is given opportunity to investigate and correct alleged errors or defects and in all cases, buyer must have notified seller thereof within one (1) year after delivery, or one (1) year after installation if the installation was accomplished by the seller.

Said warranty shall not apply if the equipment shall not have been operated and maintained in accordance with seller's written instructions applicable to such equipment, or if such equipment shall have been repaired or altered or modified without seller's approval; provided, however, that the foregoing limitation of warranty insofar as it relates to repairs, alterations, or modifications, shall not be applicable to routine preventive and corrective maintenance which normally occur in the operation of the equipment.

"EXCEPT FOR THOSE WARRANTIES SPECIFICALLY CONTAINED HEREIN, SELLER DISCLAIMS ANY AND ALL WARRANTIES WITH RESPECT TO THE EQUIPMENT DELIVERED HEREUNDER, INCLUDING THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR USE. THE SOLE LIABILITY OF SELLER ARISING OUT OF THE WARRANTY CONTAINED HEREIN SHALL BE EXCLUSIVELY LIMITED TO BREACH OF THOSE WARRANTIES. THE SOLE AND EXCLUSIVE REMEDY FOR BREACH OF THE WARRANTIES SET OUT ABOVE SHALL BE LIMITED TO THE REPAIR OR REPLACEMENT OF ANY DEFECTIVE ACCESSORY, PART OR MATERIAL WITH A SIMILAR ITEM FREE FROM DEFECT, AND THE CORRECTION OF ANY DEFECT IN WORKMANSHIP. IN NO EVENT SHALL SELLER BE LIABLE FOR ANY INCIDENTAL OR CONSEQUENTIAL DAMAGES."

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Chapter 2
Installation

2.1 General

This chapter describes the installation procedure and hardware configuration for the communications (on Mother Board and on Comm A Board option). If the communication option was installed at the factory, it may not be necessary to continue with this chapter. Proceed to Chapter 3.0, Operation.

2.2 Comm A Board (Option) Installation

To install the COMM A board, proceed as follows:

1. Select the jumper positions on the COMM A board for the desired communication standard. Below is a table which summarizes the jumper positions for selection of the electrical interface. Refer to Figure 2-1 for jumper locations.

TABLE 2-1
COMM A BOARD JUMPERS

JUMPERS							
Mode	OP1	OP2	OP3	OP4	OP5	OP6	
RS-232	"A"	"A"	"A"	"A"	"A"	"B"	
RS-485	"B"	"A"	"B"	"B"	"MDP"	"TRM"	[Default]
20 mA	"B"	"B"	"A"	"A"	"A"	"C"	

TABLE "MDP"		TABLE "TRM"	
FOR RS-485 ONLY		FOR RS-485 ONLY	
OP5		OP6	
"A"	NORMAL	"A"	TERMINATED
"B"	MULTIDROP	"B"	NOT TERMINATED

2. Open the Micro-Tech wall mount enclosure and turn power off at the mains, or remove panel mount enclosure from the panel and remove top cover allowing access to the mother board.

3. Remove the field mating connector. Wire the connector per the supplied field wiring diagram or install field terminal board cable (wall mount only).

4. Remove the hex head mounting screw from the connector end of the COMM board.

5. Insert the COMM board in any available expansion slot on the mother board (see Figure 2-2).

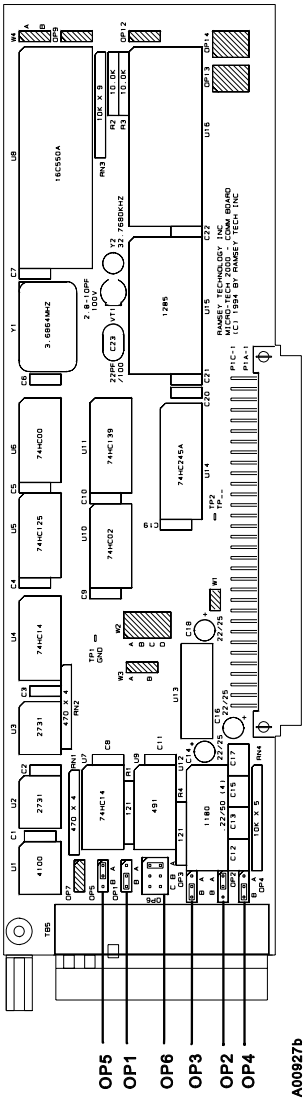
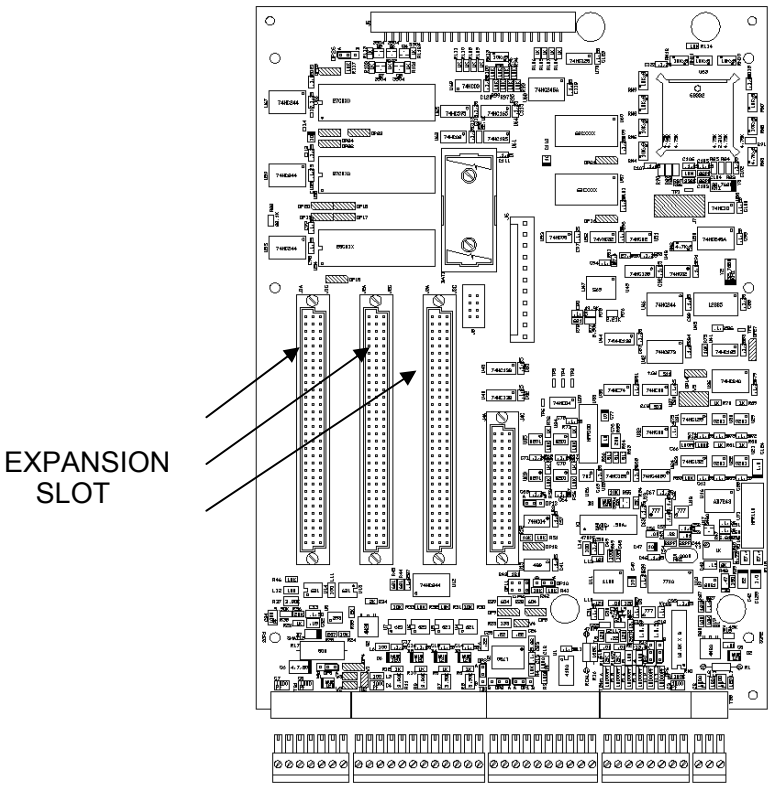


Figure 2-1 COMM A Board

Figure 2-2 Micro-Tech 3000 Mother Board



6. Insert the hex head screw through the chassis and tighten.
7. Install the wired mating connector on the COMM board connector.
8. Reinstall panel mount enclosure in the panel.
9. Turn power back on. The following screen appears when power is applied and remains on for 10 seconds.

```
-SLOT # N CHANGED
 Acquire new
 configuration?
  YES    NO
```

The screen disappears after 10 seconds if the question is not answered, and the Micro-Tech 3000 assumes the answer is NO. "HW CONFIG. CHANGED" alarm is on and cannot be reset. The above screen appears each time power is cycled if the question is not answered.

Answer YES because this is a hardware configuration change.

10. This completes the installation procedure.

11. Set-up data for the newly installed COMM board must now be entered. Proceed to Chapter 3.0, Operation.

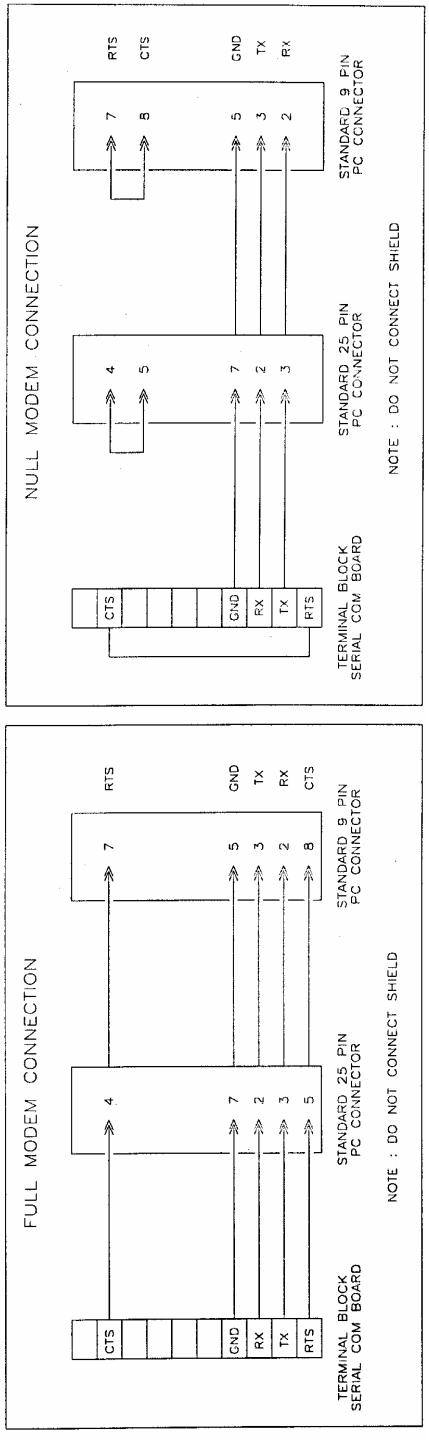


Figure 2-3 Serial Connection RS232

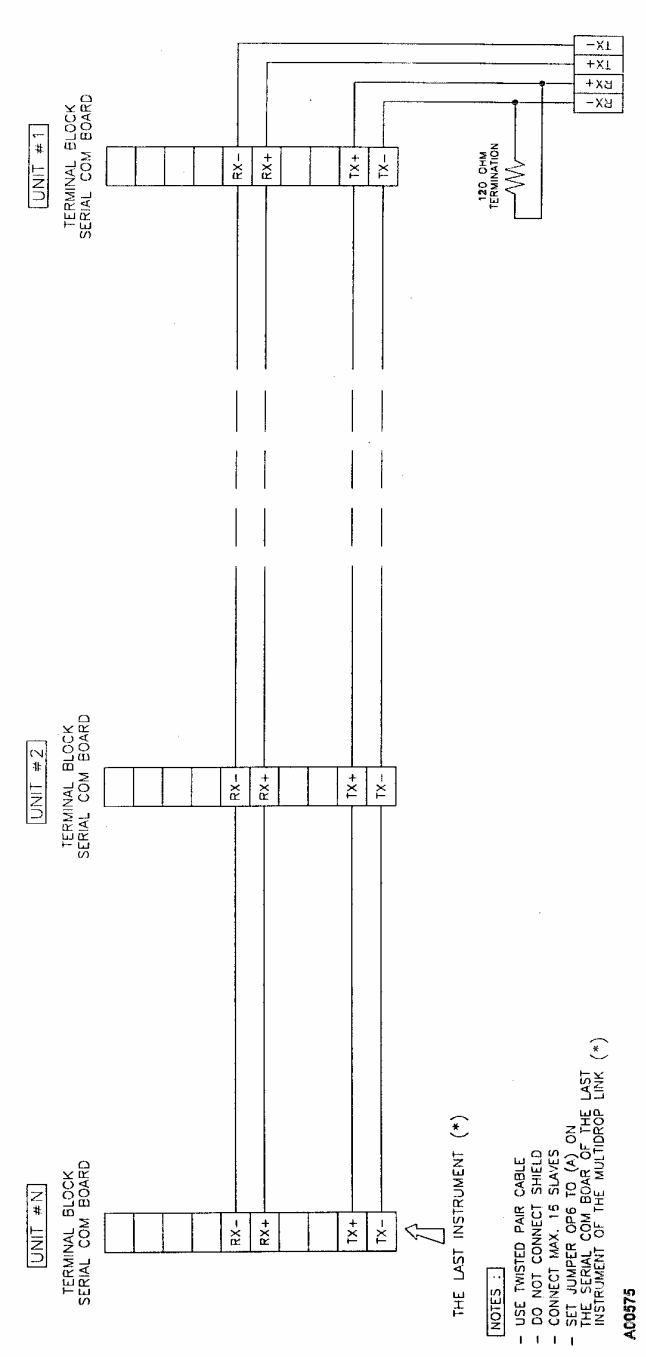


Figure 2-4 Serial Connection RS485

2.3 Communication Configuration (Mother Board) COMM1

This section describes the setup procedure and hardware configuration for the communications from the motherboard. Use the following steps to configure the communications:

Select the jumper positions for the desired communication standard. Refer to Table 2-5 for jumper locations.

Wire to the *Terminal Block 3* on the motherboard for the communication standard selected, *RS-485*, *RS-232c*, *20 mA* current loop.

Table 2-2: Mother Board COMM 1 Communications Wiring Configuration - TB3 – RS-485

Motherboard RS-485 Communications TB 3	
25	Shield
29	-RX
28	+Rx
24	Common
21	+TX
20	-TX

Maximum cable length 4000 ft
Use Beldon 9830 or equivalent

Table 2-3: Mother Board Wiring Configuration TB 3 – RS-232 Communications

Motherboard RS-232 Communications TB 3	
25	Shield
23	CTS
24	Common
22	RxD
21	TxD
20	RTS

Maximum cable length 50 ft
Use Beldon 9538 or equivalent

Table 2-4: Mother Board Wiring Configuration TB 3 – 20mA Serial Communications

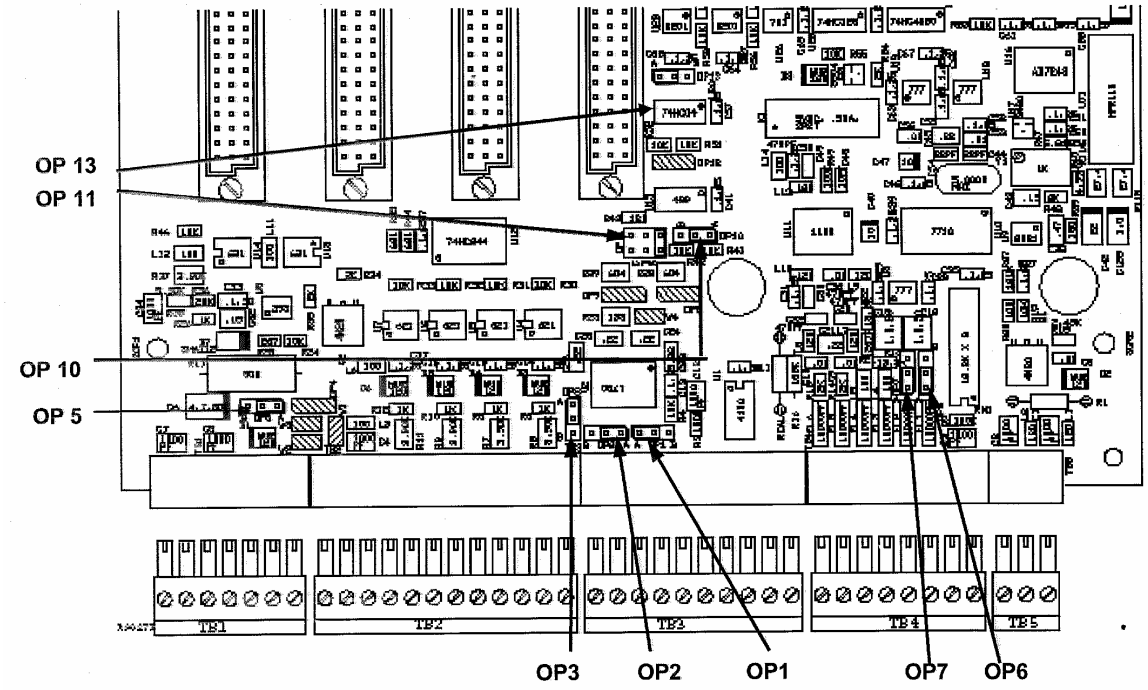
Motherboard 20 mA Serial Communications TB 3	
25	Shield
26	+20 mA (out)
27	-20 mA (out)
28	+20 mA (in)
24	-20 mA (in)

Maximum cable length 4000 ft
Use Beldon 9829 or equivalent

Table 2-5: Mother Board Communication Jumper Settings

JUMPERS							
Mode	**OP1**	**OP2**	**OP3**	**OP10**	**OP13**	**OP11**	
RS-485	"A"	"A"	"A"	"A"	"A" Normal "B" Multi-drop	"A" Terminated 'B" Not Terminated	Default
RS-232	"B"	"B"	"B"	"A"	"A" Normal	"B" Not Terminated "A" Terminated	**Default**
20 mA	"A"	"A"	"A"	"B"	"A"	"C"	

Figure 2-5: Mother Board Area of Detail



Chapter 3
Operation

3.1 General

The Micro-Tech 3000 Integrator is a bus-based menu driven machine that allows the operator easy access to all communication and printer set-up scrolls. Main Menu 3's Diagnostic Scroll contains the clock/calendar set-up screens. Main Menu 2's Display Scroll contains the clock/calendar configuration screens, and Main Menu 5 contains the communications and printer set-up scrolls.

The PRINT key enables the Micro-Tech 3000 to print the data selected in the Printer Scroll. Periodical printing and alarms print when directed by the system if enabled.

3.2 Printer Scroll

The Micro-Tech 3102 can print out several kinds of data, depending on the system set-up. When the printer has been installed and properly set up, the user can print by means of the PRINT key as described below.

When the PRINT key is pressed, the following screen is displayed:

```
-  PRINTER SCROLL   -
COM #1 no data
Start print   TOTALS
PRINT           COM
```

Password: Not required

The second line gives the status of the printer:

NO DATA	Indicates the printer is idle, no data is being sent to the printer.
IS RUNNING	Indicates the system is sending data to the printer.

The third line indicates what kind of data is printed if the PRINT soft key is pressed.

The UP and DOWN keys select between:

TOTALS C.	Print component totals (all scales if more scales defined)
TOTALS R.	Print recipe totals (all scales if more scales defined)
SETUP	Print the set-up data of the instrument.
TRAILS	If audit trails option is active, print audit trails data. (See Main Menu 6 in the Micro-Tech 3102 manual.)

Print starts after the PRINT soft key is pressed.

The COM key allows the operator to select the printer if more than one is installed.

3.3 Print Formats

The printer can be set up to print totals, batch reports, instrument set-up data, and audit trails upon request. Batch reports and audit trails require optional hardware. In addition, totals can be printed at four predetermined intervals and enabled alarms at the time they occur.

3.3.1 Totals

Examples of data that can be printed:

Print TOTALS, default:

DATE: 09-10-1998
TIME: 8:12a

C1 comp_name 0.00 Tons
C2 comp_name 0.00 Tons
.....
Cn comp_name 0.00 Tons

RECIPE TOTALS

DATE: 09-10-1998
TIME: 8:12a

R1 rec_name 0.00 Tons 0 cyc
R2 rec_name 0.00 Tons 0 cyc
.....
Rn rec_name 0.00 Tons 0 cyc

The batch report can be printed automatically at the end of a batch.
BATCH REPORT

DATE: 09-10-1998
TIME: 8:18a

RECIPE 1 rec_name
CYCLE 1 / 5
EX. TIME 1 h 12' 25" (max 8 hours)

C1 comp_name 0.00 Tons
.....
Cn comp_name 0.00 Tons

00.00 Tons

Print ALARM:
09-10-2002 8:14a
Clock fail

Print AUDIT TRAILS:
TRAIL RECORD NR 1
DATE 09-10-1998 TIME 11:59p
VARIABLE scale cap
NEW 400.00
OLD 500.00

TRAIL RECORD NR 2
DATE 09-10-1998 TIME 11:31p
VARIABLE span
NEW 250000
OLD 300000

3.3.2 Alarms

The system can optionally print out each alarm (if the alarm has been turned on in the Alarms Menu) in the following format:

09-10-2002 8:14a

Clock Fail

where "Clock Fail" is only an example of a possible alarm condition. Date and time corresponds to when the alarm has occurred the first time.

3.3.3 Set-Up

The entire system set-up data can be printed by the unit for the customer's record. Format and sequence of data can vary depending on the hardware and software configurations.

3.3.4 Audit Trails

When Audit Trails is installed, the recorded data can be printed out in the following format:

TRAIL RECORD NR 1
DATE 09-10-2002 TIME 11:59p
VARIABLE scale cap
NEW 400.00
OLD 500.00

TRAIL RECORD NR 2
DATE 09-10-2002 TIME 11:31p
VARIABLE span
NEW 250000
OLD 300000

TRAIL RECORD NR 3
DATE 09-10-2002 TIME 11:59p
VARIABLE div (e)
NEW 0.05
OLD 0.1

Each record contains a description of the variable which has been altered, the old and the new values of the variable, and an index number.

3.4 COMMUNICATION SET-UP

This section explains the communication and printer set-up. See Section 3.4 for communication protocols detailed description.

3.4.1 Clock/Calendar Set-Up

When an optional COMM "A" board is installed, date and time become available and must be set. The battery, located on the mother board, provides backup for the perpetual calendar/clock. Time and date needs to be set only once.

1. Press the MENU key until Main Menu 3 appears. Press the soft key under the DIAGNOSTICS scroll and scroll down until -DIAGNOST SCROLL 7- appears.

The following scroll is provided to set up the date, and enter the day, month and year in sequence.

```
-DIAGNOSTIC SCROLL 6-
Date:    MM-DD-YYYY
DAY:     DD
ENTER
```

Password: SERVICE

Default: 00-00-0000
Min: 01-01-0000
Max: 12-31-2096

Time is entered in a similar way. The **AM/PM** key is used when time is in the English mode (see Display Scroll 7 below).

```
-DIAGNOSTIC SCROLL 7-
Time:           HH:MM
HOURS:  HH
ENTER           AM/PM
```

Password: SERVICE

	24 hour	am/pm
Default:	00:00	01:00
Min:	00:00	01:00
Max:	23:59	12:59

2. Press the MENU key until Main Menu 2 appears. Press soft key under DISPLAY scroll and scroll down until -DISPLAY SCROLL 7- appears.

The operator can define the format for displaying and printing time and date. Select the 24 hours or 12 hours format:

```
- DISPLAY SCROLL 5 -
      Time
>am/pm h<
CHOICE   ENTER
```

Password: SERVICE

If USA or English: Default: am/pm
If other language: Default: 24 h
Selections: am/pm, 24 h

Then date can be set to show month or day first, in three possible configurations:

```
- DISPLAY SCROLL 6 -
      Date
> MM-DD-YYYY <
CHOICE   ENTER
```

Password: SERVICE

If USA: Default: MM-DD-YYYY
If other language: Default: DD-MM-YYYY
Selections: DD-MM-YYYY, MM-DD-YYYY, YYYY-MM-DD

3. When a COMM is available, date and time can be displayed line three (3) in the RUN screen if selected using DISPLAY SCROLL 9.

```
 DISPLAY SCROLL 7 & 8
Run display line 2or3
> No Display <
CHOICE   ENTER
```

Password: OPERATOR

Default: NO DISPLAY
Selections: NO DISPLAY, LOAD, SPEED, DATE/TIME

3.4.2 COMM A and Print Scroll Set-Up

Main Menu 5 is dedicated to the serial line. COMM A is used to set up the serial line of the COMM A , regardless if the serial line is connected to a computer or a PLC or for printing. The PRINT scroll is used for setting up the printer, and it only appears if the COMM A is set for printer.

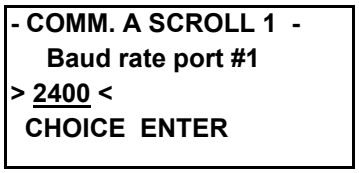
```
-  MAIN MENU 5  -
Press MENU for more

COMM A       PRINT
```

1. Line Setting and Protocol Definition

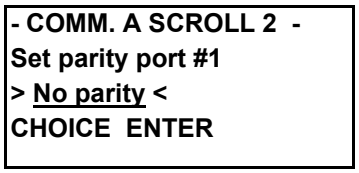
Two COMM line can be installed and programmed, typically one for the printer and one for the supervisor.

The following screens define the communication parameters for the first and the second channel.



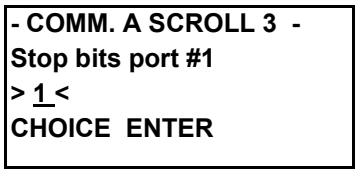
Password: Service

Default: 9600
Selections: 110, 150, 300, 600, 1200, 2400, 4800, 9600, 19200



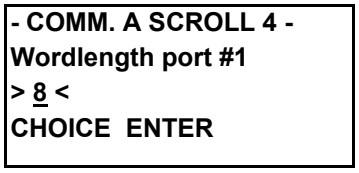
Password: Service

Default: NO PARITY
Selections: EVEN PARITY, ODD PARITY, NO PARITY



Password: Service

Default: 1
Selections: 1,2

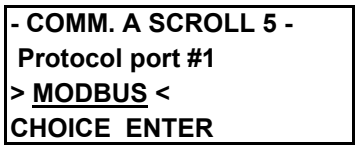


Password: Service

Default: 8
Selections: 7,8

The next screen defines the port use. Some commonly used protocols are implemented in the system. Possible selections are:

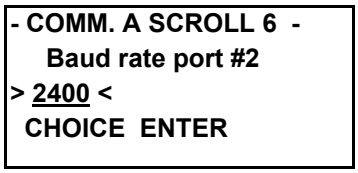
PC-MASTER	Ramsey proprietary protocol: Multidrop, Master Slave.
SIEMENS 3964R	A proprietary protocol of Siemens. Point to point, Multi Master.
ALLEN-BRADLEY DF1	A proprietary protocol of Allen-Bradley. Multidrop, Master Slave.
MODBUS	A proprietary protocol of AEG. Multidrop, Master Slave.
PRINTER	Not a protocol, selects printer output.



Password: Service

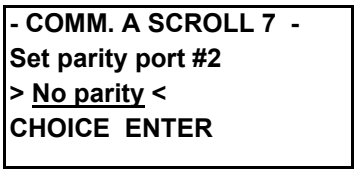
Default: PRINTER
Selections: PC-MASTER, SIEMENS 3964R, ALLEN-BRADLEY DF1, MODBUS, PRINTER

If the option COMM A board is installed, the following screen appears. These screens operate exactly as the ones dedicated to the COMM A on the Mother Board.



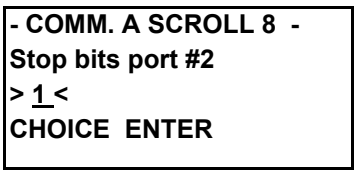
Password: Service

Default: 9600
Selections: 110, 150, 300, 600, 1200, 2400, 4800, 9600, 19200



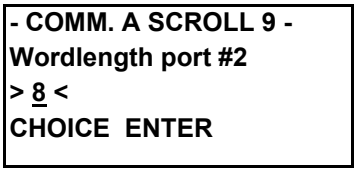
Password: Service

Default: NO PARITY
Selections: EVEN PARITY, ODD PARITY, NO PARITY



Password: Service

Default: 1
Selections: 1,2



Password: Service

Default: 8
Selections: 7,8

- COMM. A SCROLL 10 -
Protocol port #2
> PRINTER <
CHOICE ENTER

Password: Service

Default: PRINTER
Selections: PC-MASTER, SIEMENS 3964R, ALLEN-BRADLEY DF1, MODBUS, PRINTER

3.4.3 Multidrop Operator Set-Up

NOTE: This section only applies to multidrop operation. If you are using the COMM for connecting a printer, skip this section and refer to Section Printer Set-Up.
The Clear To Send (CTS) line of the port can be used for hardware handshake.
Select Enabled if you want to connect the CTS input of the system to a control signal generated by the other device.

WARNING

THE CTS INPUT CAN ONLY BE USED WHEN JUMPERS ARE SET FOR RS232. ATTEMPTING TO ENABLE THE CTS SOFTWARE CONTROL IN RS485 MODE WILL RESULT IN LOCK-UP OF THE LINE.

- COMM. A SCROLL 11 -
Clear to Send #1
> Disabled <
CHOICE ENTER

Password: Service

Default: DISABLED
Selections: ACTIVE, DISABLED

The following screens define the ADDRESS of the device in the multidrop line, and the access permission from the remote supervisor. If NONE is selected, the supervisor has full access to the device. If LIMITED is selected, the supervisor can only access those variables that are accessible with the OPERATOR password. If PROTECTED is selected, the unit is read only to the supervisor.

- COMM. A SCROLL 12 -
Address port #1
> 1 <
ENTER

Password: Service

Default: 1
Min: 1
Max: 255

- COMM. A SCROLL 13 -
Access prot port #1
> None <
CHOICE ENTER

Password: Service

Default: NONE
Selection: NONE, LIMITED, PROTECTED

Similarly for COMM 2, if installed:

3.4.4 Printer Set-Up

NOTE: This section only applies to printer. If you are using the COMM for connecting a computer, PLC or other device using a protocol, skip this section and refer to Section 3.4.3.

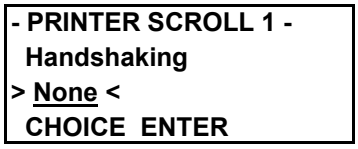
The Micro-Tech 3000 has a fully programmable printer format. The following section explains how to program the Print scroll according to the specific needs.

The system can be configured to operate without any handshake (NONE), or using the Clear To Send signal (CTS) or the XON-XOFF sequence. Refer to the instruction manual of the printer to define which selection is required. The selection NONE is only supplied for testing purposes, but is not recommended for normal use. If NONE is selected, the system is not able to recognize if the printer is on line or not, or if the paper is empty.

The most commonly used protocol is the CTS, which is a signal generated by the printer to indicate whether it is ready to receive data or not.

WARNING

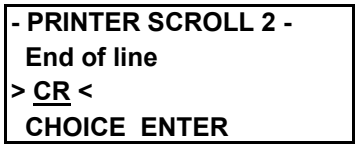
THE CTS INPUT CAN ONLY BE USED WHEN JUMPERS ARE SET FOR RS232. ATTEMPTING TO ENABLE THE CTS SOFTWARE CONTROL IN RS485 MODE WILL RESULT IN LOCK-UP OF THE LINE.



Password: Service

Default: NONE
Selection: NONE, CTS, XON-XOFF

Different printers use different end of line patterns. Select the one you need according to the printer.



Password: Service

Default: CR
Selection: CR, LF, CR+LF

Some simple printers cannot accept characters while they are printing. In some cases the handshake is not well controlled by the printer, so a delay at end of line is helpful.

- PRINTER SCROLL 3 - Delay end of line 0 sec ENTER	Password: Service

Default: 0 sec
Min: 0 sec
Max: 5 sec

A Form Feed character can be sent to the printer after each report to force the printer to eject the paper.

- PRINTER SCROLL 4 - Form Feed > NO < CHOICE ENTER	Password: Service

Default: NO
Selections: NO, YES

By selecting YES in the following screen, the system is instructed to print a batch report at the end of a recipe execution.

- PRINTER SCROLL 5 - Print Batch > No < CHOICE ENTER	Password: Service

Default: NO
Selections: YES, NO

3.4.5 Define Printing Format

By selecting YES in the following screen, the system is instructed to print one line each time a new alarm condition occurs. The alarm is printed as follows:

xx-xx-xxxx yy:yyz

kkkkkkkkkkkkkkkkkkkk

where:

xx-xx-xxxx	Day, Month, Year, printed according to the local format as defined in Main Menu 2 - Display.
yy:yyz	Hour, Minutes, am/pm printed according to the local format as defined in Main Menu 2 - Display
kkkkkkkkkkkkkkkkkkkk	Alarm message, same message appearing on the screen.

For example:

09-10-2002 8:14a
Clock Fail

```
- PRINTER SCROLL 6 -
 Print alarms
 > No <
  CHOICE    ENTER
```

Default: NO
Selections: NO, YES

If YES is selected, the system prints all alarms that have been set to alarm in the Alarm scroll.

Define first the number of strings that you want to add in your report. You may enter a number from 0 to 3. Strings can be used to add the Customer name as well as other information that you want to include in the print format.

```
- PRINTER SCROLL 7 -
String #1
 > yes <
CHOICE  ENTER
```

Password: Operator

Default: NO
Selections: YES, NO

If YES is selected, the next scroll is displayed. Use the alphanumeric keypad to enter the string (20 digits). Press the numeric key corresponding to the letter that you want to type. Every time a new key is pressed, the cursor moves to the right one place. If two times the same key is needed (for example, double letters), move the cursor right using the arrow keys (left and right softkeys).

```
- PRINTER SCROLL 7A -
Contents string #1


<        ENTER        >
```

Password: Operator

Default: “

Define if a second heading string should be added to the report.

```
- PRINTER SCROLL 8 -
String #2
 > yes <
CHOICE  ENTER
```

Password: Operator

Default: NO
Selections: YES, NO

If YES is selected, the next scrolls are displayed.

```
- PRINTER SCROLL 8A -
Contents string #2
<        ENTER        >
```

Password: Operator

Default: “

There is a third string. If only one scale is defined, it is a third heading string exactly as the previous two. If more scales are defined, it may be used to define a scale identifier. String definition is different for each scale and is used as scale heading.

```
- PRINTER SCROLL 9-
String #3
 > yes <
CHOICE  ENTER
```

Password: Operator

Default: NO
Selections: YES, NO

If YES is selected, the next scroll is displayed. The SCALE# key allows the operator to select the scale.

```
- PRINTER SCROLL 9A-
Contents string #3

                SCALE#
```

Password: Operator

Default: “

If one or more scales are defined, the ENTER and ARROWS keys appear in the fourth line of the display when the numeric or alphanumeric key is pressed.

3.5 Communication Protocols

The communication protocol allows a remote intelligent device to read and eventually write the contents of the registers as listed in this section.

During the communication activity, the Micro-Tech 3000 always acts as Slave, meaning that it will respond to a request from a Master device on the line, but never attempts to send messages out.

The instrument responds only if the message is completely received. The instrument reads the message and looks for the address, which is contained in an address byte in the query package. The message is then processed only if the address contained in the message matches the address specified in the set-up data of the instrument. When the system receives a message, the integrity of it is checked, and an answer message is prepared if yes.

The Master must respect a 100 ms interval time between two messages. If a message is sent before 100 ms have passed since the previous one, it is lost. (The data is received by an interrupt routine, while it is processed in a task which is executed each 100 ms.)

If the Master sends variables to be written in memory, the system checks the correctness of the message, and immediately sends an answer message if it is correct. This does not necessarily mean that the data is written in memory. The system first checks the address, which must correspond to a valid address of a variable, then the minimum and maximum limits are checked, and then the password. If data can be accepted, the success flag is set to 0 (no error), if not, it is set to 1. The Master needs to check the success flag (contained into a read only register), to know if the last variables sent have been stored or not.

The procedure is as follows:

- Send the data to the Micro-Tech 3000
- Wait 100 ms
- Read the success flag, should be 0.

Some data is read only, some is read write, some is write only.

> **NOTE:** The maximum number of words the system can transfer is 41 per time. Requests of registers in excess of 41 are treated as errors and do not generate an answer.

3.5.1 Register Definition

The following registers can be accessed through a serial line link using one of the available communication protocols. The table lists the registers specifying per each:

- register	A conventional name		
- type	Can be:	RO	The register can be read but cannot be written.
		RW	The register can be read or written. Write is allowed if the instrument is in the specified protection level at the moment the write message is received.
		WO	The register can only be written. Write is subject to protection control.

- low limit	The minimum acceptable value for the variable. Lower values are considered as errors.		
- high limit	The maximum acceptable value for the variable. Higher values are considered as errors.		
- refresh time	The time between two updates of the variable in the instrument's memory.		
- protection	The minimum protection level which must be in place to allow access to the variable:		
	none	always available	
	limited	available if limited or service	
	service	available if service only	
- format	Can be:	char	An ASCII string
		integer	16 bits IEEE integer
		float	32 bits IEEE float

WARNING

THE ACTUAL ADDRESS OF EACH REGISTER IS DEFINED DIFFERENTLY FOR EACH PROTOCOL AS EXPLAINED IN THE FOLLOWING SECTIONS.

3.5.2 Type, Limits and Format of Register

register	**type**	low limit	high limit	refresh time [ms]	protection	format
Success_Flag	RO	-	-	-	none	integer
Display	RO	-	-	100	-	char
Leds	RO	-	-	100	-	integer
Status	RO	-	-	100	-	integer
Alarms	RO	-	-	100	-	integer
i_o	RO	-	-	100	-	integer
Commands	WO	0	32767	100	none	integer
Running_Recipe	RW	1	_MaxRec_	-	none	integer
Set/Run_Cycle	RW	0	9999	-	none	integer
Running_Comp	RO	-	-	-	-	integer
Comp_Totals	RW	1	_MaxComp_	-	-	integer
Rec_Totals	RW	1	_MaxRec_	-	-	integer
RW_Component	RW	1	_MaxComp_	-	none	integer
RW_Recipe	RW	1	_MaxRec_	-	none	integer
RW_Rec_line	RW	1	504	-	limited	integer
Rec_Comp	RW	1	_MaxComp_	-	limited	integer
Rec_Label	RW	0	65535	-	limited	integer
Rec_set	RW	0	scale_cap	-	limited	float
Rec_Dev	RW	0	100.0 %	-	limited	float
Net_Weight	RO	-	-	100	-	float
Gross_Weight	RO	-	-	100	limited	float
Actual_Set	RO	-	-	-	none	float
Scale_Cap	RW	1	20000	-	service	float
High_Weight_Set	RW	0	100.0 %	-	limited	float

Low_Weight_Set	RW	0	100.0 %	-	limited	float
Comp#_Tot	RO	-	-	-	-	float
Comp#_LastTot	RO	-	-	-	-	float
Rec#_Tot	RO	-	-	-	-	float
Rec#_LastTot	RO	-	-	-	-	float

MacComp is the max number of components defined in the setup
MacRec is the max number of recipes defined in the setup

3.5.3 Description of Register

In the following section an explanation is given per each variable of the above table.

Success_Flag

Set to 0 after a message has been received and properly processed. If a message is correctly received but cannot be processed because password protection or size error, this flag is set to 1. The user may read this register after a write message to ensure the data have been accepted.

Display

It contains the messages actually shown on the display of the instrument in form of an ASCII string. For example, the screen:

```
- MENU MAIN 1 -
PRESS MENU FOR MORE
ZERO    SPAN    MAT'L
CAL     CAL     CAL
```

Will be stored in registers in the following way:

display(1)	2DH	20H	Characters 1 and 2 from left of first row
display(2)	4DH	45H	
display(3)	4EH	55H	
display(4)	20H	4DH	
display(5)	41H	49H	
display(6)	4EH	20H	
…..			
display(10)	….	….	Characters 19 and 20 from left of first row
displa (11)	….	….	Characters 1 and 2 from left second row
…..			
display(20)	….	….	Characters 19 and 20 from left of second row
display(21)	….	….	Characters 1 and 2 from left of third row
…..			
display(30)	….	….	Characters 19 and 20 from left of third row
display(31)	….	….	Characters 1 and 2 from left of fourth row
…..			
display(38)	4CH	20H	
display(39)	20H	20H	
display(40)	20H	20H	Characters 19 and 20 from left of fourth row

Leds

Leds(1)	bit	description	
	15	not used	
	.		
	.		
	bit	description	
	05	not used	
	04	led 5	(1 = on, 0 = off)
	03	led 4	
	02	led 3	
	01	led 2	
	00	led 1	

Status

Status(1)	bit	description
	15	cumulative shutdown (a shutdown alarm is pending)
	14	cumulative alarms (an alarm is pending)
	13	calibration running
	12	Automatic
	11	Not used
	10	High load
	09	Low load
	08	ready
	07	not used
	06	not used
	05	not used
	04	not used
	03	Batch and cycle
	02	Batch abort
	01	Batch stop
	00	Batch run

Status(2)	15-08	Batch run flags
	0 =	Not running
	1 =	Start batch
	2 =	Charge batch - wait charge interlock
	3 =	Charge batch - wait delay at the start
	4 =	Charge batch - charging at high rate
	5 =	Charge batch - charging at low rate
	6 =	Charge batch - charge end , wait stabilization time
	7 =	Refill - wait charge interlock
	8 =	Refill - wait delay at the start
	9 =	Refill - refilling

10 = Refill - refill end , wait stabilization time

11 = AutoRefill - wait charge interlock

12 = AutoRefill - wait delay at the start

13 = AutoRefill - refilling

14 = AutoRefill - refill end , wait stabilization time

15 = Discharge batch - wait discharge interlock

16 = Discharge batch - wait delay at the start

17 = Discharge batch - discharging at high rate

18 = Discharge batch - discharging at low rate

19 = Discharge batch - discharge end , wait stab.time

20 = Discharge - wait discharge interlock

21 = Discharge - wait delay at the start

22 = Discharge - discharging

23 = Discharge - discharge end , wait stab.time

24 = Recipe line end

25 = Next recipe line

07-00 Batch stop flags

0 = Not stop

1 = Stop command

2 = Discharge device open

3 = Charge interlock

4 = Discharge interlock

5 = Shut down active

6 = Power down

Status(3)	15-08	Batch abort flags
	0 =	Not abort
	1 =	Abort command
	2 =	Bad recipe
	3 =	Bad cycles
	4 =	Bad setpoint
	5 =	Manual
	07-00	Not used

Alarms

In the alarms register, each bit represents the status of an alarm. If the alarm is active, the relevant bit contains ‘1’, otherwise it contains ‘0’.

alarms(1)	bit	description
	15	CLOCK FAIL
	14	CELL FAIL
	13-10	not used
	09	RAM FAIL
	08	ROM FAIL
	07	HIGH WEIGHT
	06-03	not used
	02	LOW WEIGHT
	01-00	not used
alarms(2)	bit	description
	15-14	not used
	13	WARM START
	12	COLD START
	11	PWD DURING CALIB
	10	CAL TIME ELAPSED
	09-06	not used
	05	EXTERN ALAM 1
	04	EXTERN ALAM 2

	03	EXTERN ALAM 3
	02	HW CNF CHANGE SLOT 1
	01	HW CNF CHANGE SLOT 2
	00	HW CNF CHANGE SLOT 3
alarms(3)	bit	description
	15	
	14	
	13	
	12	BCD OVERFLOW
	11	MATHEMATIC ERROR
	10	PRINTER ERROR
	09	COMMUNICATION ERROR
	08	NOT ZERO
	07-04	not used
	03	STOP CYCLE
	02-00	not used
alarms(4)	bit	description
	15	not used
	14	END CYCLE
	13-10	not used
	09	ABORT CYCLE
	08-05	not used
	04	COMP. TIME OUT
	03-00	not used
alarms(5)	bit	description
	15	not used
	14	DEVIATION
	13-00	not used

i_o

The instrument has physical inputs and outputs to which logical input and output functions are associated. As far as communication is concerned, only the status of physical inputs and outputs are transferred.

i_o(1)	bit	description
	15-04	not used
	03	in 3 – mother board
	02	in 2 – mother board
	01	in 1 – mother board
	00	in 0 – mother board

i_o(2)	bit	description	
	15	in 3	board 4in/16out # 1
	14	in 2	board 4in/16out # 1
	13	in 1	board 4in/16out # 1
	12	in 0	board 4in/16out # 1
	11	in 3	board 4in/16out # 2
	10	in 2	board 4in/16out # 2
	09	in 1	board 4in/16out # 2
	08	in 0	board 4in/16out # 2
	07	in 3	board 4in/16out # 3
	06	in 2	board 4in/16out # 3
	05	in 1	board 4in/16out # 3
	04	in 0	board 4in/16out # 3
	03	in 3	board 4in/16out # 4
	02	in 2	board 4in/16out # 4
	01	in 1	board 4in/16out # 4
	00	in 0	board 4in/16out # 4

i_o(3)	bit	description	
	15	in 15	board 16in/4out # 1
	14	in 14	board 16in/4out # 1
	13	in 13	board 16in/4out # 1
	12	in 12	board 16in/4out # 1
	11	in 11	board 16in/4out # 1
	10	in 10	board 16in/4out # 1
	09	in 09	board 16in/4out # 1
	08	in 08	board 16in/4out # 1
	07	in 07	board 16in/4out # 1
	06	in 06	board 16in/4out # 1
	05	in 05	board 16in/4out # 1
	04	in 04	board 16in/4out # 1
	03	in 03	board 16in/4out # 1
	02	in 02	board 16in/4out # 1
	01	in 01	board 16in/4out # 1
	00	in 00	board 16in/4out # 1

i_o(4)	bit	description	
	15	in 15	board 16in/4out # 2
	14	in 14	board 16in/4out # 2
	13	in 13	board 16in/4out # 2
	12	in 12	board 16in/4out # 2
	11	in 11	board 16in/4out # 2
	10	in 10	board 16in/4out # 2
	09	in 09	board 16in/4out # 2

	08	in 08	board 16in/4out # 2
	07	in 07	board 16in/4out # 2
	06	in 06	board 16in/4out # 2
	05	in 05	board 16in/4out # 2
	04	in 04	board 16in/4out # 2
	03	in 03	board 16in/4out # 2
	02	in 02	board 16in/4out # 2
	01	in 01	board 16in/4out # 2
	00	in 00	board 16in/4out # 2

i_o(5)	bit	description	
	15	in 15	board 16in/4out # 3
	14	in 14	board 16in/4out # 3
	13	in 13	board 16in/4out # 3
	12	in 12	board 16in/4out # 3
	11	in 11	board 16in/4out # 3
	10	in 10	board 16in/4out # 3
	09	in 09	board 16in/4out # 3
	08	in 08	board 16in/4out # 3
	07	in 07	board 16in/4out # 3
	06	in 06	board 16in/4out # 3
	05	in 05	board 16in/4out # 3
	04	in 04	board 16in/4out # 3
	03	in 03	board 16in/4out # 3
	02	in 02	board 16in/4out # 3
	01	in 01	board 16in/4out # 3
	00	in 00	board 16in/4out # 3

i_o(6)	bit	description	
	15	in 15	board 16in/4out # 4
	14	in 14	board 16in/4out # 4
	13	in 13	board 16in/4out # 4
	12	in 12	board 16in/4out # 4
	11	in 11	board 16in/4out # 4
	10	in 10	board 16in/4out # 4
	09	in 09	board 16in/4out # 4
	08	in 08	board 16in/4out # 4
	07	in 07	board 16in/4out # 4
	06	in 06	board 16in/4out # 4
	05	in 05	board 16in/4out # 4
	04	in 04	board 16in/4out # 4
	03	in 03	board 16in/4out # 4
	02	in 02	board 16in/4out # 4
	01	in 01	board 16in/4out # 4
	00	in 00	board 16in/4out # 4

i_o(7)	bit	description
	15-04	not used – mother board
	03	out 3 – mother board
	02	out 2 – mother board
	01	out 1 – mother board
	00	out 0 – mother board

i_o(8)	bit	description	
	15	out 3	board 16in/4out # 1
	14	out 2	board 16in/4out # 1
	13	out 1	board 16in/4out # 1
	12	out 0	board 16in/4out # 1
	11	out 3	board 16in/4out # 2
	10	out 2	board 16in/4out # 2
	09	out 1	board 16in/4out # 2
	08	out 0	board 16in/4out # 2
	07	out 3	board 16in/4out # 3
	06	out 2	board 16in/4out # 3
	05	out 1	board 16in/4out # 3
	04	out 0	board 16in/4out # 3
	03	out 3	board 16in/4out # 4
	02	out 2	board 16in/4out # 4
	01	out 1	board 16in/4out # 4
	00	out 0	board 16in/4out # 4

i_o(9)	bit	description	
	15	out 15	board 4in/16out # 1
	14	out 14	board 4in/16out # 1
	13	out 13	board 4in/16out # 1
	12	out 12	board 4in/16out # 1
	11	out 11	board 4in/16out # 1
	10	out 10	board 4in/16out # 1
	09	out 09	board 4in/16out # 1
	08	out 08	board 4in/16out # 1
	07	out 07	board 4in/16out # 1
	06	out 06	board 4in/16out # 1
	05	out 05	board 4in/16out # 1
	04	out 04	board 4in/16out # 1
	03	out 03	board 4in/16out # 1
	02	out 02	board 4in/16out # 1
	01	out 01	board 4in/16out # 1
	00	out 00	board 4in/16out # 1

i_o(10)	bit	description	
	15	out 15	board 4in/16out # 2
	14	out 14	board 4in/16out # 2
	13	out 13	board 4in/16out # 2
	12	out 12	board 4in/16out # 2
	11	out 11	board 4in/16out # 2
	10	out 10	board 4in/16out # 2
	09	out 09	board 4in/16out # 2
	08	out 08	board 4in/16out # 2
	07	out 07	board 4in/16out # 2
	06	out 06	board 4in/16out # 2
	05	out 05	board 4in/16out # 2
	04	out 04	board 4in/16out # 2
	03	out 03	board 4in/16out # 2
	02	out 02	board 4in/16out # 2
	01	out 01	board 4in/16out # 2
	00	out 00	board 4in/16out # 2

i_o(11)	bit	description
	15	out 15 board 4in/16out # 3
	14	out 14 board 4in/16out # 3
	13	out 13 board 4in/16out # 3
	12	out 12 board 4in/16out # 3
	11	out 11 board 4in/16out # 3
	10	out 10 board 4in/16out # 3
	09	out 09 board 4in/16out # 3
	08	out 08 board 4in/16out # 3
	07	out 07 board 4in/16out # 3
	06	out 06 board 4in/16out # 3
	05	out 05 board 4in/16out # 3
	04	out 04 board 4in/16out # 3
	03	out 03 board 4in/16out # 3
	02	out 02 board 4in/16out # 3
	01	out 01 board 4in/16out # 3
	00	out 00 board 4in/16out # 3

i_o(12)	bit	description
	15	out 15 board 4in/16out # 4
	14	out 14 board 4in/16out # 4
	13	out 13 board 4in/16out # 4
	12	out 12 board 4in/16out # 4
	11	out 11 board 4in/16out # 4
	10	out 10 board 4in/16out # 4
	09	out 09 board 4in/16out # 4
	08	out 08 board 4in/16out # 4
	07	out 07 board 4in/16out # 4
	06	out 06 board 4in/16out # 4
	05	out 05 board 4in/16out # 4
	04	out 04 board 4in/16out # 4
	03	out 03 board 4in/16out # 4
	02	out 02 board 4in/16out # 4
	01	out 01 board 4in/16out # 4
	00	out 00 board 4in/16out # 4

Commands

Each bit of the commands register is specified as follows :

Bit	Description	Action
15 (MSB)	Not used	
14	Not used	
13	Not used	
12	Not used	
11	Not used	
10	Reset recipe totals	
09	Reset component totals	

08	Reset alarms
07	Not used
06	Not used
05	Not used
04	Not used
03	End cycle
02	Abort batch
01	Stop batch
00	Start batch

In order to give a command, the Host must set the relevant bit to 1 and write (send) the register to the instrument. The action is performed if the write message is accepted

- **Running_Recipe**

  It is the recipe selected to run.

- **Run/Set_Cycles**

  When read it is the number of cycle executed from the last start.

  When write it is the number of cycle to execute.

- **Running_Comp**

  It is the active at the moment or the last one activated.

- **Comp_Totals**

Define the first component for the access to the component total registers. See Comp#_Tot and Comp#_LastTot

- **Rec_Totals**

  Define the first recipe for the access to the recipe total registers. See Rec#_Tot and Rec#_LastTot

- **RW_Comp**

  Define the component of which to access to the total registers (Comp_Total and Comp_LastTotal).

- **RW_Recipe**

  Define which recipe has to be enabled to read or write the recipe parameters (Rec_Comp, Rec_Label, Rec_Dev, Rec_Set) or read the recipe total registers (Rec_Total, Rec_LastTotal).

- **RW_RecLine**

  Define which line of the recipe has to be enabled to read or write the recipe parameters (Rec_Comp, Rec_Label, Rec_Dev, Rec_Set).

Rec_Comp

It is the component number of the selected recipe (RW_Recipe) at the selected line (RW_RecLine).

- **Rec_Label**

It is the label number of the selected recipe (RW_Recipe) at the selected line (RW_RecLine).

Rec_Set

It is the set point of the selected recipe (RW_Recipe) at the selected line (RW_RecLine).

- **Rec_Dev**

It is the maximum deviation of the selected recipe (RW_Recipe) at the selected line (RW_RecLine).

- **Net_Weight**

Actual net weight.

Gross_Weight

Actual Gross weight.

- **Actual_Set**

Set point actually in use or last used.

Scale_Cap

The max capacity of the scale. Entered by the user at first start up, should never be altered.

High_Weight_Set

It is the set point for the alarm of high weight.

- **Low_Weight_Set**

It is the set point for the alarm of low weight.

Comp#_Total

Are areas of 10 float numbers containing the component total registers. The first float of the ten is referred to the component specified in 'CompTotal' word, the second to CompTotal+1 and so on.

Comp#_LastTotal

Are areas of 10 float numbers containing the component last total registers. The first float of the ten is referred to the component specified in 'CompTotal' word, the second to CompTotal+1 and so on.

Rec#_Total

Are areas of 10 float numbers containing the recipe total registers. The first float of the ten is referred to the recipe specified in 'RecTotal' word, the second to RecTotal+1 and so on.

Rec#_LastTotal

Are areas of 10 float numbers containing the recipe last total registers. The first float of the ten is referred to the recipe specified in 'RecTotal' word, the second to RecTotal+1 and so on.

Span Indicate the span in use in the scale.

Zero Indicate the zero in use in the scale.

3.6 PC-Master Protocol

The PC-Master protocol is fully described in the following manual (available from Thermo Ramsey on request) :

PC-MASTER COMMUNICATION PROTOCOL

The following messages are used to communicate with MT3100 type of instruments:

- Message #97 : Send a Key to the MT3000
- Message #98 : Send a variables to the MT3000
- Message #99 : Get variables from the MT3000

3.6.1 Description

1. Message #97 : SEND A KEY TO THE 3100

   With this command, the code of one or more kays can be sent to the instrument. When the keys are received by the instrument, they are processed as the normal keyboard entries.

   QUERY MESSAGE

Begin of frame	STX	02
	DLE	10H
Address	xxx	xxx
Code	97	61H
Stamp	xxx	xxx
Data	KEY	1byte
Error check	xxx	xxx
End of frame	ETX	03

   RESPONSE MESSAGE

   No response is provided.

   TABLE OF THE KEYS

KEY	HEX CODE	KEY	HEX CODE
UP ARROW	48H	EIGHT	38H
DOWN ARROW	50H	NINE	39H
DECIMAL POINT	2EH	MENU	4DH
CLEAR	53H	RUN	52H
ZERO	30H	F1	3FH
ONE	31H	F2	40H
TWO	32H	F3	41H
THREE	33H	AUTO/MAN	3BH
FOUR	34H	LOC/REM	3CH
FIVE	35H	START	3DH
SIX	36H	STOP	3EH
SEVEN	37H		

Example :

The Host sends the “MENU”key to 3100 (Address of Slave 1) :

HOST (PLC)		SLAVE (3102)
02H	→	
10H		
01H		
61H		
01H		
4DH		
B0H		
03H	→	

2. Message #98 : SEND A VARIABLE TO THE 3102

With this command, the master sends registers to the slave unit.

QUERY MESSAGE

Begin of frame	STX	02
	DLE	10H
Address	xxx	xxx
Code	98	62H
Stamp	xxx	xxx
Data	Address	1WORD
	WordCount	1WORD
	DATA	WordCount WORDS
Error check	xxx	xxx
End of frame	ETX	03

RESPONSE MESSAGE

Begin of frame	STX	02
	DLE	10H
Address	xxx	xxx
Code	98	62H
Stamp	xxx	xxx
Data	Address	1WORD
	WordCount	1WORD
Error check	xxx	xxx
End of frame	ETX	03

Example :

The Host wants to write the COMMAND (address 5E hex) word to 2:

Address of Slave : 1

HOST (PLC)		SLAVE (Micro-Tech 3102)
02H	→	
10H		
01H		
62H		
01H		
00H		
5EH		
00H		
01H		
00H		
02H		

HOST (PLC)		SLAVE (Micro-Tech 3102)
C5H		
03H	→	
	←	02H
		10H
		01H
		62H
		01H
		00H
		5EH
		00H
		01H
		C3H
	←	03H

3. Message #99 : READ REGISTER FROM THE 3002

With this command, the master asks the slave unit for registers.

QUERY MESSAGE

Begin of frame	STX	02
	DLE	10H
Address	xxx	xxx
Code	99	63H
Stamp	xxx	xxx
Data	Address	1WORD
	WordCount	1WORD
Error check	xxx	xxx
End of frame	ETX	03

RESPONSE MESSAGE

Begin of frame	STX	02
	DLE	10H
Address	xxx	xxx
Code	99	63H
Stamp	xxx	xxx
Data	Address	1WORD
	WordCount	1WORD
	DATA	n. WORDS
Error check	xxx	xxx
End of frame	ETX	03

Example :

The Host wants to write the RUN RECIPE (address 5F hex) word:
RUN RECIPE value : 5
Address of Slave: 1

HOST (PLC)		SLAVE (Micro-Tech 3102)
02H 10H 01H 63H 01H OOH		
5FH 00H 01H C5H 03H	----->	
	<-----	02H 10H 01H 63H 01H 00H
		5FH 00H 01H 00H 05H CAH
		03H

3.7 Siemens 3964R

3.7.1 Description

The protocol has been implemented as described in – “Funzioni di accoppiamento con CP 525/2 Manuale – Simatic S5” – Siemens.

Two communication modes are provided :

FETCH	The HOST asks the slave unit for register
SEND	The HOST sends registers to the slave

The choice between requesting or sending data is made using a specific code inside the message.

3.7.2 Write Register

HOST (PLC)			SLAVE (Micro-Tech 3100)	
STX	(02H)	-->		
		<--	DLE	(10H)
HEDING TEL HI	(00H)	-->		
HEDING TEL LO	(00H)			
COMAND HI	(41H)			
COMAND LO	(44H)			
DESTINATION DB	(00H)			
DESTINATION DW	(XXH)			
NUMBER BYTES HI	(00H)			
NUMBER BYTES LO	(XXH)			
no CF	(FFH)			
all CPUs	(FFH)			
DATA MSB				

....				
DATA LSB				
DLE	(10H)			
ETX	(03H)			
BCC	(XXH)			
		<--	DLE	(10H)
			STX	(02H)
DLE	(10H)	-->		
		<--	HEDING TEL HI	(00H)
			HEDING TEL LO	(00H)
			NOT USED	(00H)
			NUMBER ERROR	(00H)
			DLE	(10H)
			ETX	(03H)
			BCC	(XXH)
DLE	(10H)	-->		

Example:

The Host wants to write the HIGH LOW SET at 100.0%:

HOST (PLC)		SLAVE (Micro-Tech 3100)
02H	----->	
		<------ 10H
00H 00H 41H 44H 00H 7BH		
00H 02H FFH FFH 42H C8H		
00H 00H 10H 03H E5H	----->	
		<------ 10H 02H
10H	----->	
		<------ 00H 00H 00H 00H 10H 03H 13H
10H	----->	

3.7.3

3.7.4 Read Register

HOST (PLC)			SLAVE (Micro-Tech 3102)	
STX		-->		
		<--	DLE	(10H)
HEDING TEL HI	(00H)	-->		
HEDING TEL LO	(00H)			
COMAND HI	(45H)			
COMAND LO	(44H)			
DESTINATION DB	(00H)			
DESTINATION DW	(XXH)			
NUMBER BYTES HI	(00H)			
NUMBER BYTES LO	(XXH)			
no CF	(FFH)			
all CPUs	(FFH)			
DLE	(10H)			
ETX	(03H)			
BCC	(XXH)			
		<--	DLE	(10H)
			STX	(02H)
DLE	(10H)	-->		
		<--	HEDING TEL HI	(00H)
			HEDING TEL LO	(00H)
			NOT USED	(00H)
			NUMBER ERROR	(XXH)
			DATA LSB	
			MAX 127BYTES	
			DATA MSB	
			DLE	(10H)
			ETX	(03H)
			BCC	(XXH)
DLE	(10H)	-->		

Example:

The Host wants to receive the HIGH LOAD SET.

HIGH LOAD SET: 100.0%

HOST (PLC)		SLAVE (Micro-Tech 3102)
02H	----->	
	<------	10H
00H 00H 45H 44H 00H 7BH		
00H 02H FFH FFH 10H 03H		
6BH	----->	
	<------	10H
	<------	02H
10H	----->	
	<------	00H 00H 00H 00H 42H C8H
		00H 00H 10H 03H 99H
10H	----->	

3.8 MODBUS

This protocol has been implemented as described in: - "Gould Modicon Modbus Protocol" - Reference Guide - November 1993 - Rev. A (Gould Inc. Programmable Control Division)

NOTE: Only a subset of the protocol has been implemented, as described in this chapter.

3.8.1 Read Register

QUERY

Address	xxx
function	03H
add. hi	xxx
add. lo	xxx
n.data hi	xxx
n.data lo	xxx
n. data hi	xxx
n. data lo	xxx
crc 16 lo	xxx
crc 16 hi	xxx

RESPONSE MESSAGE

Address	xxx	
function	03H	(83H in case of error)
Byte cnt	xxx	
Data MSB	xxx	
…..	xxx	
Data LSB	xxx	
crc16 lo	xxx	
crc16 hi	xxx	

Example:

The Host wants to write the RUN RECIPE (96 dec) word.

RUN RECIPE value: 5

Address of Micro-Tech 3102: 1

HOST (PLC) SLAVE (Micro-Tech 3102)

01H 03H 00H 5FH 00H 01H B4H 18H

-->

<-- 01H 03H 04H 00H 05H 78H 47H

Exceptions:

The Micro-Tech 3102 handles the following exceptions:

Illegal address	exception code = 02	address is not correct or number of registers overlaps the max limit (42).

3.8.2 Write Register

QUERY

Address	xxx
function	10H
add. hi	xxx
add. lo	xxx
n. data hi	xxx
n. data lo	xxx
n. bytes	xxx
Data MSB	xxx

…..	xxx
Data LSB	xxx
crc16 lo	xxx
crc16 hi	xxx

RESPONSE MESSAGE

Address	xxx	
function	10H	(90H in case of error)
add. hi	xxx	
add. lo	xxx	
n. data hi	xxx	
n. data lo	xxx	
crc16 lo	xxx	
crc16 hi	xxx	

Example:

The Host wants to write the RUN RECIPE (96 dec) to 2 and RUN CYCLE (97 dec) to 5 :

Address of Micro-Tech 3102: 1

HOST (PLC) SLAVE (Micro-Tech 3102)

01H 10H 00H 5FH 00H 02H 04H 00H -->

02H 00H 05H D7H 10H

<-- 01H 10H 00H 5FH 00H 02H 71H DAH

Exceptions:

The Micro-Tech 3102 handles the following exceptions:

Illegal address	exception code = 02	address is not correct or number of registers overlaps the max limit (42).
Illegal value	exception code = 03	value is out of the limits or protected.

3.8.3 Write Word

QUERY

Address	xxx
function	06H
add. hi	xxx
add. lo	xxx
value hi	xxx

value lo	xxx
crc16 lo	xxx
crc16 hi	xxx

RESPONSE MESSAGE

Address	xxx	
function	06H	(86H in case of error)
add. hi	xxx	
add. lo	xxx	
value hi	xxx	
value lo	xxx	
crc16 lo	xxx	
crc16 hi	xxx	

Example:

The Host wants to write the COMMAND word to 1 (start batch):

Address of Micro-Tech 3102: 1

HOST (PLC) SLAVE (Micro-Tech 3100)

01H 06H 00H 5EH 00H 01H 29H D8H -->

<-- 01H 06H 00H 5EH 00H 01H 29H D8H

Exceptions:

The Micro-Tech 3102 handles the following exceptions:

Illegal address	exception code = 02	address is not correct or number of registers overlaps the max limit (42).
Illegal value	exception code = 03	value is out of the limits or protected.

3.9 Allen-Bradley DF1 (PLC-5)

3.9.1 Description

The DF1 is a propietary protocol of Allen-Bradley. The protocol has been implemented according to : Allen-Bradley “Reference Manual–Data Highway / Data Highway Plus Protocol and Command Set”.Pubblicat. 1770-6.5,16 September 1991.

WARNING

ONLY A SUBSET OF THE PROTOCOL HAS BEEN IMPLEMENTED. THE COMMANDS USED TO READ OR WRITE THE REGISTERS ARE : TYPED READ (CODE 68H) AND TYPED WRITE (67H).

3.9.2 Read Register

- Connect message

This message must be sent from Host to Slave before a request of sending data can be performed.

HOST (PLC)		SLAVE (3102)
DLE	(10H)	→
SOH	(01H)	
ADDRESS OF SLAVE		
DLE	(10H)	
STX	(02H)	
ADDRESS OF SLAVE		
ADDRESS OF HOST		
COMMAND	(OF H)	
STS	(00H)	
TMS	(xxH)	
TMS	(xxH)	
FNC	(68 H)	
PACKET OFFSET (LOW)		
PACKET OFFSET (HIGHT)		
TOTAL TRANS (LOW)		
TOTAL TRANS (HIGH)		
ADDRESS OF DATA (FIRST BYTE)		
ADDRESS OF DATA (SECOND BYTE)		
ADDRESS OF DATA (THIRD BYTE)		
ADDRESS OF DATA (FOURTH BYTE)		
SIZE OF DATA IN ELEMENTS (LOW)		
SIZE OF DATA IN ELEMENTS (HIGH)		
DLE	(10H)	
ETX	(03H)	
BCC		→
		← DLE (10H)
		← ACK (06H)

- The HOST (PLC) asks for data from the Slave (3102) :

This message is sent from the Host to the Slave to request a certain number of data:

HOST (PLC)		SLAVE (3102)		
DLE	(10H)	→		
ENQ	(05H)			
ADDRESS SLAVE				
BCC		→		
		←	DLE	(10H)
			STX	(02H)
			ADDRESS HOST	
			ADDRESS SLAVE	
			4FH	(COMMAND)
			STS	(00H)
			TMS	(xxH)
			TMS	(xxH)

			TYME DATA PARAMETER
			DATA LSB MSB
			…….
			DATA LSB MSB
			DLE (10H)
			ETX (03H)
		←	BCC
DLE	(10H)	→	
ACK	(06H)	→	

Example:

The Host wants to receive the RUN RECIPE (N7:63):

HOST (PLC)		SLAVE (Micro-Tech 3102)	
10H 01H 01H 10H 02H 01H			
01H 0FH 00H 00H 00H 68H			
00H 00H 01H 00H 07H 00H			
07H 3FH 01H 00H 10H 03H			
37H	----->		
		<-----	10H 06H
10H 05H 01H FFH	----->		
		<-----	10H 02H 01H 01H 4FH 00H
			00H 00H 99H 09H 03H 42H
			05H 00H 10H 03H C3H
10H 06H	----->		

3.9.3 Write Register

Send data

This message is used from the Host to download registers into the Micro-Tech 3102.

HOST (PLC)		SLAVE (Micro-Tech 3102)
DLE (10H)	-->	
SOH (01H)		
ADDRESS OF SLAVE		
DLE (10H)		
STX (02H)		
ADDRESS SLAVE		
ADDRESS HOST		
COMMAND (OF H)		
STS (00H)		
TMS (xxH)		
TMS (xxH)		
FNC (67 H)		

PACKET OFFSET (LOW)			
PACKET OFFSET (HIGH)			
TOTAL TRANS (LOW)			
TOTAL TRANS (HIGH)			
ADDRESS OF DATA (FIRST BYTE)			
ADDRESS OF DATA (SECOND BYTE)			
ADDRESS OF DATA (THIRD BYTE)			
ADDRESS OF DATA (FOURTH BYTE)			
TYPE DATA PARAMETER			
DATA LSB MSB			
...			
DATA LSB MSB			
DLE (10H)			
ETX (03H)			
BCC	-->		
	<--	DLE	(10H)
		ACK	(06H)

Ask if data ok:

HOST (PLC)		SLAVE (Micro-Tech 3102)
DLE (10H)	-->	
ENQ (05H)		
ADDRESS SLAVE		
BCC	-->	
	<--	DLE (10H)
		STX (02H)
		ADDRESS HOST
		ADDRESS SLAVE
		4FH (COMMAND)
		STS (00H)
		TMS (xxH)
		TMS (xxH)
		DLE (10H)
		ETX (03H)
		BCC
DLE (10H)	-->	
ACK (06H)		

If the message is incorrectly received, the Micro-Tech 3102 will not respond.The character 10H is doubled (sent two times), but is computed only once in the BCC.

Example:

The Host wants to write the COMMAND WORD (N7:62) to 4:

Address of Slave:02

Address of Host: 01

HOST (PLC)			SLAVE (Micro-Tech 3102)
10H 01H 01H 10H 02H 01H 01H			
0FH 00H 00H 00H 67H 00H 00H			
01H 00H 07H 00H 07H 3EH 99H			
09H 07H 42H 04H 00H 10H 03H			
AFH	----->		
		<-----	10H 06H
10H 05H 02H FEH	----->		
		<-----	10H 02H 01H 01H 4FH 00H
			00H 00H 10H 03H AFH
10H 06H	----->		

3.10 Register Mapping

register	Modbus	PCMaster & Siemens	Allen Bradley	note
success_flag	33	20H	N7:0	0 successful, 1 failed.
display(1)	34	21H	N7:1	
display(2)	35	22H	N7:2	
display(3)	36	23H	N7:3	
display(4)	37	24H	N7:4	
display(5)	38	25H	N7:5	
display(6)	39	26H	N7:6	
display(7)	40	27H	N7:7	
display(8)	41	28H	N7:8	
display(9)	42	29H	N7:9	
display(10)	43	2AH	N7:10	
display(11)	44	2BH	N7:11	
display(12)	45	2CH	N7:12	
display(13)	46	2DH	N7:13	
display(14)	47	2EH	N7:14	
display(15)	48	2FH	N7:15	
display(16)	49	30H	N7:16	
display(17)	50	31H	N7:17	
display(18)	51	32H	N7:18	
display(19)	52	33H	N7:19	
display(20)	53	34H	N7:20	
display(21)	54	35H	N7:21	
display(22)	55	36H	N7:22	
display(23)	56	37H	N7:23	
display(24)	57	38H	N7:24	
display(25)	58	39H	N7:25	
display(26)	59	3AH	N7:26	

display(27)	60	3BH	N7:27	
display(28)	61	3CH	N7:28	
display(29)	62	3DH	N7:29	
display(30)	63	3EH	N7:30	
display(31)	64	3FH	N7:31	
display(32)	65	40H	N7:32	
display(33)	66	41H	N7:33	
display(34)	67	42H	N7:34	
display(35)	68	43H	N7:35	
display(36)	69	44H	N7:36	
display(37)	70	45H	N7:37	
display(38)	71	46H	N7:38	
display(39)	72	47H	N7:39	
display(40)	73	48H	N7:40	
leds	74	49H	N7:41	
status(1)	75	4AH	N7:42	
status(2)	76	4BH	N7:43	
status(3)	77	4CH	N7:44	
alarm_status(1)	78	4DH	N7:45	
alarm_status(2)	79	4EH	N7:46	
alarm_status(3)	80	4FH	N7:47	
alarm_status(4)	81	50H	N7:48	
alarm_status(5)	82	51H	N7:49	
i_o(1)	83	52H	N7:50	
i_o(2)	84	53H	N7:51	
i_o(3)	85	54H	N7:52	
i_o(4)	86	55H	N7:53	
i_o(5)	87	56H	N7:54	
i_o(6)	88	57H	N7:55	
i_o(7)	89	58H	N7:56	

i_o(8)	90	59H	N7:57	
i_o(9)	91	5AH	N7:58	
i_o(10)	92	5BH	N7:59	
i_o(11)	93	5CH	N7:60	
i_o(12)	94	5DH	N7:61	
Commands	95	5EH	N7:62	
Run_recipe	96	5FH	N7:63	
Run/set_cycle	97	60H	N7:64	
Run_component	98	61H	N7:65	
RW_CompRecTot	99	62H	N7:66	
RW_Recipe	100	63H	N7:67	
RW_RecLine	101	64H	N7:68	
RecLine_Comp	102	65H	N7:69	
RecLine_Label	103	66H	N7:70	
RecLine_set(1)	104	67H	F8:0	
RecLine_set(2)	105	68H		
RecLine_dev(1)	106	69H	F8:1	
RecLine_dev(2)	107	6AH		
Reserved	108	6BH	F8:2	
Reserved	109	6CH		
Reserved	110	6DH	F8:3	
Reserved	111	6EH		
Reserved	112	6FH	F8:4	
Reserved	113	70H		
Reserved	114	71H	F8:5	
Reserved	115	72H		
Net_weight(1)	116	73H	F8:6	
Net_weight(2)	117	74H		
Gross_weight(1)	118	75H	F8:7	
Gross_weight(2)	119	76H		

Actual_set(1)	120	77H	F8:8	
Actual_set(2)	121	78H		
Scale_capacity(1)	122	79H	F8:9	
Scale_capacity(2)	123	7AH		
High_load_set(1)	124	7BH	F8:10	
High_load_set(2)	125	7CH		
Low_load_set(1)	126	7DH	F8:11	
Low_load_set(2)	127	7EH		
C_Total_#1(1)	128	7FH	F8:12	
C_Total_#1(2)	129	80H		
C_Total_#2(1)	130	81H	F8:13	
C_Total_#2(2)	131	82H		
C_Total_#3(1)	132	83H	F8:14	
C_Total_#3(2)	133	84H		
C_Total_#4(1)	134	85H	F8:15	
C_Total_#4(2)	135	86H		
C_Total_#5(1)	136	87H	F8:16	
C_Total_#5(2)	137	88H		
C_Total_#6(1)	138	89H	F8:17	
C_Total_#6(2)	139	8AH		
C_Total_#7(1)	140	8BH	F8:18	
C_Total_#7(2)	141	8CH		
C_Total_#8(1)	142	8DH	F8:19	
C_Total_#8(2)	143	8EH		
C_Total_#9(1)	144	8FH	F8:20	
C_Total_#9(2)	145	90H		
C_Total_#10(1)	146	91H	F8:21	
C_Total_#10(2)	147	92H		
C_LastTotal_#1(1)	148	93H	F8:22	
C_LastTotal_#1(2)	149	94H		

C_LastTotal_#2(1)	150	95H	F8:23	
C_LastTotal_#2(2)	151	96H		
C_LastTotal_#3(1)	152	97H	F8:24	
C_LastTotal_#3(2)	153	98H		
C_LastTotal_#4(1)	154	99H	F8:25	
C_LastTotal_#4(2)	155	9AH		
C_LastTotal_#5(1)	156	9BH	F8:26	
C_LastTotal_#5(2)	157	9CH		
C_LastTotal_#6(1)	158	9DH	F8:27	
C_LastTotal_#6(2)	159	9EH		
C_LastTotal_#7(1)	160	9FH	F8:28	
C_LastTotal_#7(2)	161	A0H		
C_LastTotal_#8(1)	162	A1H	F8:29	
C_LastTotal_#8(2)	163	A2H		
C_LastTotal_#9(1)	164	A3H	F8:30	
C_LastTotal_#9(2)	165	A4H		
C_LastTotal_#10(1)	166	A5H	F8:31	
C_LastTotal_#10(2)	167	A6H		
R_Total_#1(1)	168	A7H	F8:32	
R_Total_#1(2)	169	A8H		
R_Total_#2(1)	170	A9H	F8:33	
R_Total_#2(2)	171	AAH		
R_Total_#3(1)	172	ABH	F8:34	
R_Total_#3(2)	173	ACH		
R_Total_#4(1)	174	ADH	F8:35	
R_Total_#4(2)	175	AEH		
R_Total_#5(1)	176	AFH	F8:36	
R_Total_#5(2)	177	B0H		
R_Total_#6(1)	178	B1H	F8:37	
R_Total_#6(2)	179	B2H		

R_Total_#7(1)	180	B3H	F8:38	
R_Total_#7(2)	181	B4H		
R_Total_#8(1)	182	B5H	F8:39	
R_Total_#8(2)	183	B6H		
R_Total_#9(1)	184	B7H	F8:40	
R_Total_#9(2)	185	B8H		
R_Total_#10(1)	186	B9H	F8:41	
R_Total_#10(2)	187	BAH		
R_LastTotal_#1(1)	188	BBH	F8:42	
R_LastTotal_#1(2)	189	BCH		
R_LastTotal_#2(1)	190	BDH	F8:43	
R_LastTotal_#2(2)	191	BEH		
R_LastTotal_#3(1)	192	BFH	F8:44	
R_LastTotal_#3(2)	193	C0H		
R_LastTotal_#4(1)	194	C1H	F8:45	
R_LastTotal_#4(2)	195	C2H		
R_LastTotal_#5(1)	196	C3H	F8:46	
R_LastTotal_#5(2)	197	C4H		
R_LastTotal_#6(1)	198	C5H	F8:47	
R_LastTotal_#6(2)	199	C6H		
R_LastTotal_#7(1)	200	C7H	F8:48	
R_LastTotal_#7(2)	201	C8H		
R_LastTotal_#8(1)	202	C9H	F8:49	
R_LastTotal_#8(2)	203	CAH		
R_LastTotal_#9(1)	204	CBH	F8:50	
R_LastTotal_#9(2)	205	CCH		
R_LastTotal_#10(1)	206	CDH	F8:51	
R_LastTotal_#10(2)	207	CEH		
Span (1)	208	CFH	F8:52	
Span (2)	209	D0H		

Zero (1)	210	D1H	F8:53	
Zero (2)	211	D2H		

Chapter 4
Maintenance

4.1 General

Refer to the Micro-Tech 3102 manual for maintenance information.

Chapter 5 Parts

5.1 General

Refer to the Micro-Tech 3102 manual for parts information.