NBT

SM800 Series

Table 2 Reference

COMMUNICATIONS CONFIGURATION

1. Table 2 (Communication Table)

The basic function of "Table 2" is to set up communications between RTU's.

Table 2 consists of a block of 900 holding registers and an associated setup parameters. The Table 2 display shows 60 line numbers which show the communication setup parameters (polling, read/write functions, etc.). What you see in the 'Table 2' display is the 60 lines of setup parameters.

The holding registers can be accessed directly from the Table 2 lines, or passively from other areas of the system.

For example, a line (or point) might be setup to read some remote slave station registers into a set of Table 2 registers. The contents of the Table 2 registers could then be used by a BASIC program, read into Table 1 points, or accessed by a PC via serial port.

Typically, Table 2 registers are blocks of registers read from, or written to, a remote station. Several methods for sending and receiving data from remote stations are described in this section.

The other major sources of data used in Table 2 is the station's physical I/O and Table 1 register data. This type of data is frequently consolidated in Table 2 for retrieval by another site.

Example:

	Enable	Port/Typ	Ph#/Err	Trig By	Rd/Send	StaAddr	DataTyp	FWA I/O	Length	Storage	Register
Line 10	ON	Comm	0	0	Read	3	BLK-TB2	4	11	Assign	100

Note: This line will cause the unit to poll Station 3 and read registers 4 through 14 of its Table 2 and store that data into this units Table 2 at register 100 through 110 via the Comm Port (front DB9). Since the trigger point is 0, the request will be polled continuously (every scan cycle).

1.1 Table 2 Menus

The menu listing is mostly self-explanatory but there are a few points to consider.

1. The "FAX" option under the phone number is only available using the internal NBT dial-up modem.

2. The "Pager" option requires two phone numbers: 1) the pager service modem number, and 2) the actual pager phone number. The two numbers are separated by a slash ("/").

3. The pagers require their own baud rate settings which will return to normal after calling the pager service.

Note: the internal dial modem will negotiate the pager service baud rate automatically if supported by the pager service.

1.2 Column Definitions

1.2.1 Alphabetically by column letter (A-Q+)

Column	Name	Definition
A	REQ.ACT	Indicates the current activity status for this line.
B	ENABLE	Activates polling of remote unit specified when set to ON. Data may be read/written from Table 1 with ENABLE set to OFF, but the STATUS must be "Comm. OK".
C	PORT/TYP	Specifies the communication port to use, the choices are:

For all:
LOCAL: For accessing registers in this unit
PORT 0: Use port 0 (left DB9 male)

For internal 202 modem:
COMM: Communication port (RJ11)
PORT 1: Port 1 (right DB9, male)

For internal dial modem:
PORT 1: Communication port (RJ11)
COMM: Right DB9, female (RS232)

| D | Ph#/Err | The phone numbers are listed 1-6. Select the list number for the phone number desired. If there is no phone number in the list item then communication is assumed to be a direct connection. |

If set to COMM, this is the number of times a communication failure occurred.

| E | TRIG BY | REGISTER DATA: Point number in Table 1 that will cause a data transmission, if zero (0), then continuous data transfer. |

EVENT READ: Station qualifier, only events originating from this station will be processed to Table 2 registers.

EVENT WRITE: Station qualifier, only events originating in this station number will be sent.

F	RD/SEND	Direction of data flow, reading from or writing to (sending).
G	STA ADDR	The station address referred to in RD/SEND column (F).
H	DATA TYP	The data type being transmitted; the data types are:

EVENTS	Event messages (history file data)
BLK-TB1	Register data from Table 1
BLK-TB2	Register data from Table 2
BLK-DIO	Direct access to digital I/O modules
BLK-AIO	Direct access to analog I/O modules
BLK-D&A	Direct access to analog & digital mod.
COMM-STS	Maps communication status bits
BLK-T1EX	Table 1 Min, Max and times registers
BLK-SMEX	Table 1 summary data (yesterday)

Note: for Pager lines, use BLK-TB2.

Cont'd

Note: for Fax or Text lines:
   EVENTS = History Log of qualified points
   BLK-TB1 = Table 1 Lines
   BLK-TB2 = single line Alarm Message
   BLK-T1EX = Tablel 1 Lines w/ M/M & time regs
   BLK-SMEX = Table 1 Lines w/ M/M & yest M/M

I	FWA I/O	REGISTER DATA: This specifies the first register to be read/written based on the above data type ("First Word Address").
		EVENT READ: The first point number of range in remote unit.
		EVENT WRITE: *If column J=0:* this is the station number. *If column J <> 0:* This is the first point number of range in remote unit.
J	LENGTH	REGISTER DATA: This specifies the total number of registers to be read in, using the previous column for the starting position.
		EVENT READ: Point range, number of points included in read processing.
		EVENT WRITE: If set to non-zero, columns I & J become range qualifiers and events transmit at time of occurrence or upon trigger.
K	SRC/EPTR	If the DATA TYP is set to EVENTS this shows the local pointer position for the history file. The unit will continue trying to send events until this pointer matches the pointer in the history file.
L	STORAGE	The two options are Allocate and Assign. Allocate is the normal operation and will automatically increment the register pointer to accommodate the number of registers needed. The Assign is used when you want to manually set the starting register.
M	REGISTER	This specifies the starting register for this row.
N	STATUS	Shows communication status for this line. If the status is "Failed" Table 1 will not be updated with data from this line. "Failed" occurs if four successive communication attempts fail.
O	REG 00	The first register in this row. The REGISTER field determines the starting position of the 900 registers. For example, if REGISTER field is set to 80 then first register used for this row would be REG 80
P	REG 01	This is the next register for this row. As per above example, this would be REG 81.
Q	REG 02	This is the next register for this row. As per above example, this would be REG 82.
	REG xx	Thirty registers are displayed per row.

1.2.2 Alphabetically by column name ("Data Typ" - "Trig By")

NAME	COLUMN	DEFINITION
DATA TYP	H	The data type being transmitted; the data types are:

EVENTS	Event messages (history file data)
BLK-TB1	Register data from Table 1
BLK-TB2	Register data from Table 2
BLK-DIO	Direct access to digital I/O modules
BLK-AIO	Direct access to analog I/O modules
BLK-D&A	Direct access to analog & digital mod.
COMM-STS	Maps communication status bits
BLK-T1EX	Table 1 Min, Max, and times registers
BLK-SMEX	Table 1 summary data (yesterday)

Note: for Pager lines, use BLK-TB2.

Note: for Fax or Text lines*:*
  EVENTS= History Log of qualified points   (Format 1)
  BLK-TB1= Tbl1 Lines   (Format 2)
  BLK-TB2= single line alarm mess.   (Format 3)
  BLK-DIO= Large Font -Table 1 points   (Format 4)
  BLK-AIO= Large Font-active alarms only   (Format 5)
  BLK-T1EX= Tbl1 Lines w/ M/M & time regs (Format 6)
  BLK-SMEX=Tbl1 Lines w/ M/M & yest M/M (Format 7)

NAME	COLUMN	DEFINITION
ENABLE	B	Activates polling of remote unit specified when set to ON. Data may be read/written from Table 1 with ENABLE set to OFF, but the STATUS must be "Comm. OK".
FWA I/O	I	REGISTER DATA: This specifies the first register to be read/written based on the data type (noted above).

EVENT READ: The first point number of range in remote unit.

EVENT WRITE: *If column J=0,* then it is the station number.
If column J <> 0, then this is the first point number of range in remote unit.

NAME	COLUMN	DEFINITION
LENGTH	J	REGISTER DATA: This specifies the total number of registers to be read in, using the previous column for the starting position.

EVENT READ: Point range, number of points included in read processing.

EVENT WRITE: If set to non-zero, columns I & J become range qualifiers and events transmit at time of occurrence or upon trigger.

NAME	COLUMN	DEFINITION
Ph#/Err	D	The phone numbers are listed 1-6. Select the list number for the phone number desired. If there is no phone number in the list item then communication is assumed to be a direct connection.

			If set to COMM then this is the number of times a communication failure occurred.
PORT/TYP	C		Specifies the communication port to use, the choices are:
			For all: LOCAL: For accessing registers in this unit PORT 0: Left DB9, male
			For internal 202 modem: COMM: Communication port (RJ11) PORT 1: Use port 1 (right DB9, male)
			For internal dial modem: PORT 1: Communication port (RJ11) COMM: Right DB9, female (RS232)
RD/SEND	F		Direction of data flow, reading or writing
REG 00	O		The first register in this row. The REGISTER field determines the starting position of the 900 registers. For example, if the REGISTER field is set to 80 then the first register used for this row would be REG 80.
REG 01	P		This is the next register for this row. As per above example, this would be REG 81.
REG 02	Q		This is the next register for this row. As per above example, this would be REG 82.
REG xx			Thirty registers are displayed per row.
REGISTER	M		This specifies the starting register for this row.
REQ.ACT	A		Indicates the current activity status for this line .
SRC/EPTR continue	K		If the DATA TYP is set to EVENTS this shows the local pointer position for the history file. The unit will trying to send events until this pointer matches the pointer in the history file.
STA ADDR	G		The station address referred to in RD/SEND column (F).
STATUS	N		Shows communication status for this line. If the status is "Failed" Table 1 will not be updated with data from this line. "Failed" occurs if four successive communication attempts fail.
STORAGE	L		The two options are Allocate and Assign. Allocate is the normal operation and it will automatically increment the register pointer to accommodate the number of registers needed. The Assign is used when you want to manually set the starting register.
TRIG BY	E		REGISTER DATA: Point number in Table 1 that will cause a data transmission, if zero (0), then continuous data transfer. EVENT READ: Station qualifier, only events originating from this station will be processed to Table 2 registers. EVENT WRITE: Station qualifier, only events originating in this station number will be sent.

1.3 Special Addresses and Registers

The SM805 has special RTU addresses and registers to handle unique communications and special functions.

1.3.1 Global RTU addresses

Address 250: BROADCAST

Address 250 is used for broadcasting data to multiple RTU's. Every RTU will receive data when it is addressed by its own address, <u>or address 250</u>. When an RTU receives data via address 250 there is no acknowledgment from the RTU. This address can be used to transmit the time and date registers and , in effect, synchronize the "real-time-clocks"with the master.

Address 245: UNIVERSAL

Address 245 is also a special purpose address that every RTU will respond to <u>and</u> acknowledge. However, this special address <u>only works with ports "P0" and "P1"</u> on the SM805. This is most commonly used with computer based master software during system checkout. In the field, multiple RTU's can be quickly checked without having to set different addresses (in the master software) for each one.

1.3.2 Special function time / date registers

Registers 901 through 907 are time and date registers. These registers are automatically updated from the "real-time-clock". They may not appear to be updating when viewed in Table 2 due to the relatively slow table scan rate, but the registers are up to the second. A master unit may transmit these registers to another RTU which will synchronize its real-time-clock to the new time).

901 - Seconds

902 - Minutes

903 - Hour

904 - Day

905 - Month

906 - Year

907 - Weekday

1.3.3 Special function enable / disable registers

Table 1 and Table 2 lines are executed in a linear fashion from lowest to highest line number. Registers 908 and 909 allow the disabling of any line or all lines in either table. Register 908 controls Table 2, and register 909 controls Table 1.

908 - Entering 1-60 in this register will effectively disable that line number in Table 2.
Entering 255 in this register will disable all lines in Table 2.

909 - Entering 1-180 in this register will block Alarm and Event actions for that line number in Table 1.
Entering 255 in this register will block Alarm and Event actions for all line numbers in Table 1.

1.3.4 Communication tracking registers

Three registers in Table 2 track communications. On a given port, each communication transmission will increment a separate counter (the counter will wrap when full). This is commonly used in diagnosing communication problems or tracking communication transmissions.

911 - Counts "Comm Port" transmissions (internal modem)

912 - Counts "Port 0" transmissions

913 - Counts "Port 1" transmissions

1.4 Serial Port Baud Setting

The baud rate for serial port 1, or "P1", is shown above the column displays in Table 2, and can be set via menu selection. Note that if the internal dial modem is present, port 1 is the Comm Port, or "Comm" and is Modbus only.

Serial port 0 ("P0") is set by the front panel DIP switches 3 and 4.

1.5 Remote Station Direct I/O

A master station can read a slave station's Table 1 and Table 2 registers, and/or directly read the physical I/O modules connected to the slave station. This allows remote access to that data without any configuration or setup at the remote slave station.

Note: data retrieved in this mode is in raw data form (no scaling, etc.).

Remote stations may be polled for data without setting up any information in Table 2 (at the remote site) if the remote hardware is scanned.

Each analog input module needs 8 registers and each digital unit needs 1 register.
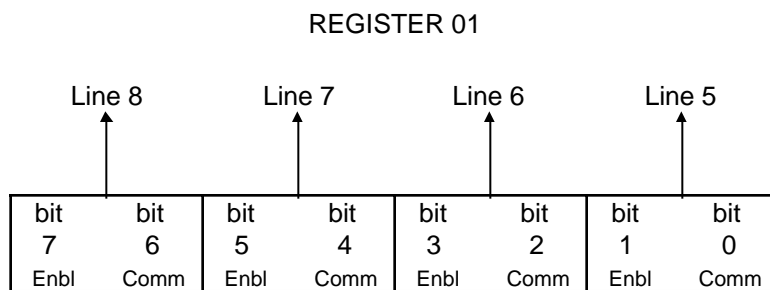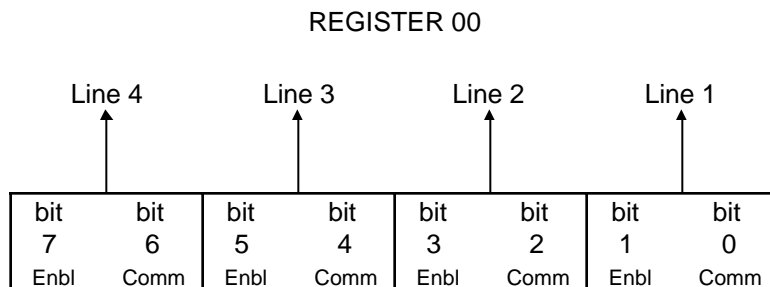
1.6 Communications Status ("COMM-STS")

The "communication status" and "enable status" can be monitored for any or all Table 2 lines. For example, a communication failure could be used to trigger a message, fax, or other programmable function.

The *"Status"* field (column N) indicates whether the communications for that line is "Comm O.K." or "Failed". The *"Enable"* field (column B) indicates the line is turned "on" or turned "off".

To monitor communication and enable status, the "COMM-STS" function is used in the *"Data Typ"* field (column H) of Table 2. It will assign a group of registers to contain the "communication" and "enable" status bits. The bits will be assigned to the appropriate registers automatically.

The bits are arranged in pairs, one pair for each <u>line number</u>. The first bit of the pair is used for the "status" and the second is for the "enable". These pairs fill the registers in order (i.e., bits 0-7 and lines 1-60, respectively).

Each register contains 4 pairs of communication/enable bits (8 bits total). Therefore, each register contains information for 4 lines in Table 2. As each register is "filled" (i.e., all 8 bits are used), the bits are stored in the next consecutive register (illustrated below). Also shown on the next page is a complete table of line numbers and bit/register positions.

REGISTER 00

Line 4		Line 3		Line 2		Line 1	
bit 7	bit 6	bit 5	bit 4	bit 3	bit 2	bit 1	bit 0
Enbl	Comm	Enbl	Comm	Enbl	Comm	Enbl	Comm

REGISTER 01

Line 8		Line 7		Line 6		Line 5	
bit 7	bit 6	bit 5	bit 4	bit 3	bit 2	bit 1	bit 0
Enbl	Comm	Enbl	Comm	Enbl	Comm	Enbl	Comm

The following is a table that shows the registers and bit positions for all 60 Table 2 lines.

BIT POSITION

Register Number	7	6	5	4	3	2	1	0
x + 0	4E	4C	3E	3C	2E	2C	1E	1C
x + 1	8E	8C	7E	7C	6E	6C	5E	5C
x + 2	12E	12C	11E	11C	10E	10C	9E	9C
x + 3	16E	16C	15E	15C	14E	14C	13E	13C
x + 4	20E	20C	19E	19C	18E	18C	17E	17C
x + 5	24E	24C	23E	23C	22E	22C	21E	21C
x + 6	28E	28C	27E	27C	26E	26C	25E	25C
x + 7	32E	32C	31E	31C	30E	30C	29E	29C
x + 8	36E	36C	35E	35C	34E	34C	33E	33C
x + 9	40E	40C	39E	39C	38E	38C	37E	37C
x + 10	44E	44C	43E	43C	42E	42C	41E	41C
x + 11	48E	48C	47E	47C	46E	46C	45E	45C
x + 12	52E	52C	51E	51C	50E	50C	49E	49C
x + 13	56E	56C	55E	55C	54E	54C	53E	53C
x + 14	60E	60C	59E	59C	58E	58C	57E	57C

Key:
Number   =Table 2 Line Number
E   =Enable bit
C   =Communicaton bit
X   =Starting register number

For example, say you want to monitor line 27 of Table 2 for communication status. For this example, the first register used will be 0 (x=0). First, find the number 27C (for line 27, and the "communication" bit) in the chart above. Next, follow the column up from "27C", and you will find a bit position of "4". Following the row left from "27C", you will find the register number "6". That's it! Now when you set up a line in Table 1 to use this information, simply plug in register 6, bit 4 in the appropriate columns (T and U, respectively).

Note: Communication Status bit: 0 = "Comm O.K."
                                            1 = "Failed"

            Enable Status bit: 0 = "Disabled"
                                            1 = "Enabled"

To use the COMM-STS function, set up a Table 2 line with these parameters:

Column	Name	Choose this parameter
B	ENABLE	ON
C	PORT/TYP	LOCAL
D	Ph#/Err	0
E	TRIG BY	0
F	RD/SEND	READ FM
H	DATA TYP	COMM-STS
I	FWA I/O	0
J	LENGTH	This field determines the number of registers to reserve for the "COMM-STS" function. To monitor any of the first <u>four</u> line numbers, a "Length" of 1 is needed. To monitor any of the first <u>eight</u>, a "Length" of 2 is needed, etc. This continues up to a "Length" of 15, which would use 15 registers, and would hold the bits for all 60 lines. (Remember, each register stores the bit data for <u>4 line numbers</u>)
L	STORAGE	"Allocate" will automatically decide which registers will be used, according to the next available register. "Assign" will use the value you entered in the "Register" field as the first register.
M	REGISTER	The starting register if above column is "Assign", otherwise it is automatically set

To utilize these bits, set up a line in Table 1 with the following parameters:

Column	Name	Parameter
P	HW TYPE	TABL2-LN
Q	PT TYPE	DIG IN
S	MOD ADDR	Station number for this unit
T	REG/PT	Register number you want to read
U	BIT POS	Bit number you want to read

1.7 Single Master Networks

The roles of master and slave are determined by which unit has requests for communication in Table 2. If both stations have communications requests active, then they are both considered as masters and will time share the channel.

Note that competing masters will have collisions and retries which will detract from the throughput of a single Master circuit

1.7.1 Setting Scan Speed

If a single master network can be utilized, the scan speed of the COMM port can be sped up by decreasing the 'pause' time allowed for multiple masters. This is accomplished by selecting "ScanParams" from the menu line. You then can select (via arrow up/ down) to pick RBE (Multiple masters), fast, medium, or slow single master modes.

Adjustment of scan speed is provided so that the percent of active transmit time can be limited.

RBE inserts a random delay at the onset of any communications to insure that all stations that want to transmit will get a "turn" on the channel.

1.8 Multiple Master/Report by Exception Comm.

1.8.1 Port 1 Access (Right DB9, or internal modem)

The SM805 can associate Table 2 lines to any of the three communications ports: Port 0 ("P0"), Port 1 ("P1"), or Comm Port ("Comm"). The type of communications from ports 0 or 1 can be Modbus (direct or dial), Pager (dial only), Fax (internal dial modem only)or Text alarm messages (direct or dial).

1.8.1.1 Dial Operation

Two fields are displayed in the Header area for each of 6 possible phone numbers. The first is the phone number itself which can be modified via the menu line. The second is the "phone number *type"* field which also can be accessed via the Menu line. The phone number types are: C for computer (Modbus protocol), T for text (Alarm print out messages), P for Pager (Alarm notification messages) and F for FAX (Alarm notification or logging messages).

A phone number which is blank implies that the connection is direct.

1.8.1.2 Pager Operation

The "pager" selection must have a phone number entry and it must contain the pager service <u>modem number</u> followed by a '/' and the regular phone number of the individual pager.

The message delivered to the pager is of the form:

001-002-111 where: **001** = the station number
                              002 = the trigger point number that initiated the message
                              111 = three individual alarm indicators; i.e., three separate bits
                                        (set from Table 1 alarm conditions)

1.8.1.3 Text (or Fax) Alarm or Logging Messages

Text alarm messages, logs, and event printouts can be generated and sent directly to a local or serial printer.

FORMAT 1 - ANALOG LOGGED EVENTS (DataType = Events)

```
11/02  16:01:00    00983.S001P012        CurrVal of  TANK2  = -00004
11/02  16:02:00    00986.S001P012        CurrVal of  TANK2  = -00004
11/02  16:03:00    00989.S001P012        CurrVal of  TANK2  = -00004
11/02  16:04:00    00992.S001P012        CurrVal of  TANK2  = -00004
11/02  16:05:00    00995.S001P012        CurrVal of  TANK2  = -00005
11/02  16:06:00    00998.S001P012        CurrVal of  TANK2  = -00003
```

FORMAT 2 - ALARM NOTIFICATION (single or multi-point)

```
                  VALUE         MAX/CYC  MIN/RT

001  MAJR ALM    OFF            00000.   00000.
```

FORMAT 3 - ALARM NOTIFICATION (Single Table 2 Line)

```
*** 11/10/94  13:25:15  STA: 001  27TH ST.  TRIG. PT 099    S1COMAL     00000.
```

FORMAT 4 - LARGE FONT ALARM NOTIFICATION (Datatype = BLK-DIO)

```
          VALUE        MAX/CYC  MIN/RT

MAJR ALM    OFF        00000.   00000.
```

FORMAT 5 - LARGE FONT ACTIVE ONLY ALARM NOTIFICATION (Datatype = BLK-AIO)

ACTIVE ALARMS:

```
                VALUE      MAX/CYC  MIN/RT

MAJR ALM   ON              00005.    00001.
```

OR-

NO ALARMS ACTIVE

FORMAT 6 - (Datatype = BLK-T1EX)

ALARM/PERIODIC LOG of point range with times

- • With Maximum / Minimum values, for day or since triggered reset.
- • For digital points: shows START and ONTIME in minutes.
- • Includes LAST ON and OFF TIMES for digital points.

```
                           VALUE          MAX/CYC   MIN/RT    MX TIME    MN TIME

Sunnyval  001  MAJR ALM    OFF            00000.    00000.    00:00:00   00:00:00

Sunnyval  002  AC PWRIN    0014.8   VOLT  0015.3    0000.0    01:23:34   13:57:58

Sunnyval  003  DI INT 0    OFF            00000.    00000.    00:00:00   00:00:00

Sunnyval  004  TEST        00008.   MV    00008.    00008.    00:00:00   00:00:00
```

FORMAT 7.   (Datatype = BLK-SMEX)

- ALARM/PERIODIC LOG of point range with YESTERDAY'S MIDNIGHT READINGS

- • With MAXIMUM / MINIMUM values, for day or since triggered reset.
- • For digital points: shows STARTS and ONTIME in minutes.

```
11/10/94  13:58:58         VALUE          MAX/CYC   MIN/RT    YEST MX   YEST MN

27TH ST.  020  PUMP 1      ON             00153.    00026.    00000.    00000.

27TH ST.  021  PUMP 2      ON             00153.    00026.    00000.    00000.
```

1.8.1.4 Fax Messages

If Fax logging is selected, the same types and formats of messages available in the "text mode" can be sent directly to a fax machine.

In addition, each page will have a header line containing the station name and address, as well as the time, date, and page number. An "ATTN:" salutation can be entered via the menu line to address the fax to a particular individual or department.

SAMPLE - Page header and salutation (the station name is user defined)

STA: 27TH ST. 001   11/10/94   13:13:36   PAGE 001

ATTN: JOHN DOE

1.8.2 Time out operation

The Header area of Table 2 displays a field called "MaxTO". The value displayed (0-15) may be edited from the menu line.

If the value is 0 - the communications time-out operation is "normal", which means:

- consecutive failures will result in a FAILED condition.

- Any successful communication will restore communications to OK.

- If the station is FAILED, then an attempt to re-establish communications will be made every 4th scan cycle.

If the value is 1-15 - the retry scheme is as follows:

For Modbus direct (includes COMM port):

After "failure" (3 tries), the time-out will pause for one minute before a retry is attempted. If the retry is unsuccessful, the next time-out will wait for two minutes. The pause time will increase in one minute intervals until the "MaxTO" value is reached, and will remain at that time-out interval until communications are restored.

For Dial operations:

Operates similar to the direct method described above, but increments of time are in tens of minutes instead of minutes.
Therefore, the time-out pause ranges from 10 minutes to 150 minutes.

1.8.3 Triggered poll operations

If the TRIGGER BY column has a non-zero entry, it represents a point number (line number) in Table 1. The alarm actions of that point will initiate the Table 2 line operation specified.

Note: In many cases you may want to have the alarm action of the triggered point only initiate the Table 2 line operation on a leading edge. (as opposed to both leading and trailing edges) In order to do this, use the Alarm Action field in the "Trigger" point to suppress the trailing edge alarm actions.

1.8.4 10-12bit conversion transfers

The SM805 has a block move feature for moving blocks of registers within Table 2. A special condition of this transfer will allow raw 10 bit analog data to be transformed as 12 bit raw analog data. This can be helpful when A/D and D/A resolutions are not the same or when the PC software is expecting a 12 bit format for analog data.

To enable this special mode, set the Port to local and the station number to 255. If the station number is other than 255, the transfer will be without translation.

1.9 Communication Examples

1.9.1 Simple Direct I/O Read

To perform a read of one or more I/O modules from a remote station requires only one request from a Table 2 line. The following line parameters demonstrate the action (Line 1 used as example):

Table 2, line 1, in the NBT Programmer edit box: (could be any line in Table 2)

By setting up one line in Table 2, an image of the current values of the physical inputs connected to station 2 is continuously being scanned (read) into registers of Table 2 starting at register 500 (in this example).

Just as easily, a line in Table 2 could be set up to read registers from the RTU's Table 2 registers or from its Table 1 registers. Write operations, where register contents are sent to the RTU, are accomplished by changing the Read selection (column F) to a Write selection.

1.9.2 Simple Alarm Reporting examples

1.9.2.1 Pager Notification

The following example is provided to illustrate the set up a pager notification. Assume that line 20 in Table 1 has been configured as the triggering point (i.e., Major Alarm).

Table 2, line 1, in the NBT Programmer edit box: (could be any line in Table 2)

To set the phone numbers and phone number types, click the "pocket knife" icon in the programmer. The following edit box will appear:

The drop-down boxes on the right are used to select the communications type. All are shown above for illustration purposes.

Cont'd

In menu line, select Phone # 1:   enter: 5551212/3334567   Sets paging service modem access number (e.g., 5551212) plus the pager's phone number (e.g., 3334567)

In menu line, select Phone#Type: select "P"   (for Pager)

THE RESULT:

Sends the following message to Pager number 333-4567:   001-001-000 (meaning: Station 1, Line 1 alarm. The last three bits are optional encoded alarm bits from Table 1.

1.9.2.2 *Fax or Printer - Text Alarm Printing*

The following example is provided to illustrate the set up a text alarm notification. Fax messaging is similar, except set phone number type to 'F' in the online mode, or select "Fax" or in the Programmer. Assume that Line 10 in Table 1 has been configured as the triggering point (i.e., Major Alarm).

Table 2, line 1, in the NBT Programmer edit box: (could be any Line in Table 2)

To set the phone numbers and phone number types, click the "pocket knife" icon in the programmer. The following edit box will appear:

The drop-down boxes on the right are used to select the communications type. All are shown above for illustration purposes.

Or, in the online mode:

In menu line: select Phone # 1:   enter: 5551212   Set alarm fax phone number.

In menu line: select Phone#Type   select: "F"   (for Fax)

THE RESULT:

Sends the following message to the fax machine at 555-1212:

   10:11:00 4/30/97   Sta 001 Point 001   ON   00123

" 00123" is the value contained in the associated Table 2 register.

Setting the DATA TYPE field to Table1, Events, or TB1EXP, or SUMEXP will allow logging of different formats and data.

1.9.3 Simple Event Reporting

The following example is provided to illustrate the set up of event transmission to a master station. Assume that Line 30 in Table 1 has been configured as the triggering Point (i.e., Major Alarm).

Table 2, line 1, in the NBT Programmer: could be any line in Table 2)

To set the phone numbers and phone number types, click the "pocket knife" icon in the programmer. The following edit box will appear:

The drop-down boxes on the right are used to select the communications type. All are shown above for illustration purposes.

Cont'd

Or, in the online mode:

In menu line select: Phone # 1,   enter: 5551212   Set Event Processor phone number.
Blank or null implies direct (local)
connect)

In menu line-select: Phone#Type, enter "C"   (for Computer)

THE RESULT:

Sends events to the computer at 555-1212.

1.10 Table 2 Transfer Examples

1.10.1 Continuous Transfers

Continuous transfers of data into or from Table 2 are used to provide real-time images of I/O or calculated data. This data is available to other stations (by transfer) or for access from Table 1 or a BASIC program.

A continuous transfer is specified if the Trigger Pt (column E) is set to 0.

1.10.2 Triggered Transfers

The SM805 can conditionally transfer data to or from Table 2 registers by setting the trigger point field (column E) to a Table 1 line number. The alarm action of the Table 1 point will cause the transfer associated with the Table 2 line.

The Table 1 parameters will determine if transfers are triggered on the leading edge only, or both leading and trailing edge.

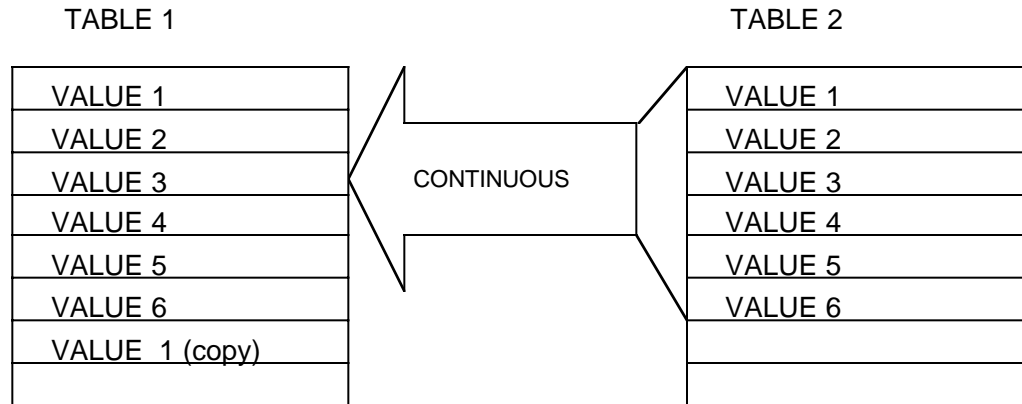Any combination of timing and event points can be used to cause a trigger.

1.10.3 Rotating a set of values in Table 1

For pump alternation, or other reasons, it may be desired to "rotate" a set of registers in Table 1. One option is to use a "triggered read" to read the block of registers into Table 2. A block of registers can be shifted by intentionally reading the block offset by one register. The "trigger point" for this read can be any Table 1 point and can be based on any desired criteria.

Example:

a) NORMAL

TABLE 1		TABLE 2
VALUE 1		VALUE 1
VALUE 2	CONTINUOUS	VALUE 2
VALUE 3		VALUE 3
VALUE 4		VALUE 4
VALUE 5		VALUE 5
VALUE 6		VALUE 6
VALUE 1 (copy)		

b) ROTATE

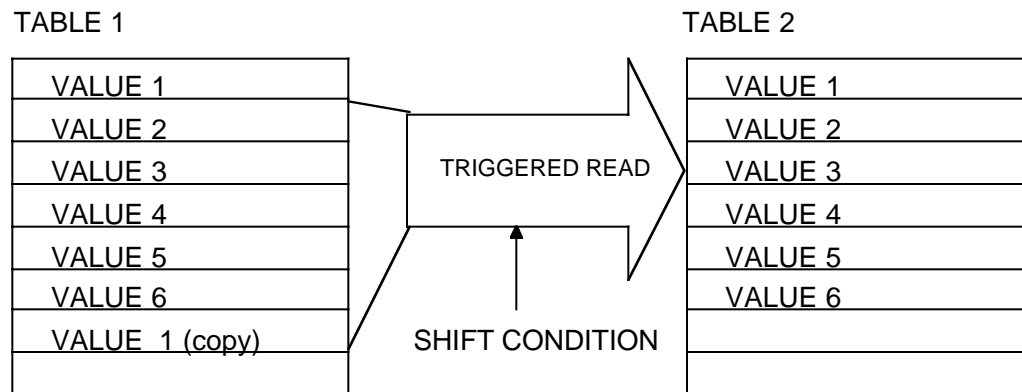| TABLE 1		TABLE 2
VALUE 1		VALUE 1
VALUE 2		VALUE 2
VALUE 3	TRIGGERED READ	VALUE 3
VALUE 4		VALUE 4
VALUE 5		VALUE 5
VALUE 6		VALUE 6
VALUE 1 (copy)	SHIFT CONDITION	

TABLE 1 SHIFT via TABLE 2

1.11 Local Transfers into Table 2

Five significant types of local data are available to Table 2 via a "local" transfer.

A local transfer is specified by setting the Table 2 "Port/Typ" field (column C) to "LOCAL".

By setting up a line as a local transfer, a block of registers in Table 2 can be defined to receive and hold the following information:

1. The "CURVAL" data registers of this station (Table 1)
2. The current raw I/O data registers of this station (I/O modules)
3. The min / max and time registers (Table 1)
4. Summary registers (same as above) from yesterday's file (Table 1)
5. The communications status and enable flag for each individual station defined in Table 2 (Table 2)

For SCADA applications, where the unit is acting as a "dumb" RTU, a complete image of the local input raw data can be captured in Table 2 registers.

Data from remote slave stations can be read from, or written to, specified Table 2 registers. The remote station's Table 1 or Table 2 registers can be the source or destination of data.

2. Utility Information

2.1 Saving a Customized Setup File

Configuration information is stored in nonvolatile memory so that it is never lost.

A customized point configuration can be saved for permanent reference by selecting the *"Transfer"* menu option and then *"Save-to-CD"* to transfer the data to a memory cartridge.

Uploading and downloading of point configuration files to a PC is supported using the XModem transfer.

BASIC programs can also be saved as files, see the BASIC section for details.

2.2 Loading Configurations

DIP switch settings (SW5) can be used to force clearing of the configuration file to a default condition. This is relevant during initial startup (power-up).

2.2.1 XModem Transfers

A new or revised program configuration can be saved to, or loaded from, a connected computer file via Xmodem transfer.

The options for an XModem transfer are:

1. Send Database (To Computer)
2. Send Current & Summary Data
3. Load Database (From Computer)
4. Offload History
5. Exit To RT-Display

If you are not already "online", save any changes you may have made, and go online (described in section 3.2.1). The XModem transfer options are available in the main menu of Table 1, under *"Transfer"*.

The sequence in the Programmer is:

1. Press the "/" key to access the menu line, select *"Transfer"*, then *"Xmodem"*.
2. Select transfer option (1-5 above)*.
3. Then click the large 'up arrow' or 'down arrow' icon in the upper left of the screen (with the "X" in it); these refer to upload or download respectively.
4. Select the desired file to transfer.

* (After selecting one of the five options, the computer has 15 seconds to start the file transfer. If the file transfer is not started within 15 seconds the RTU will automatically return to its normal mode.)

A display box will show the transfer progress as it occurs .

Note: After a file transfer <u>to</u> the RTU, the "scan" is disabled. Restart the scan from the main menu line under the *"Station"* option. The unit will restart automatically if the power is reset.

2.2.2 BASIC Program Transfers

Basic programs may be saved to the computer using the ASCII file transfer protocol in the programmer. Use the *"Communication"* menu item in the online mode to select ASCII upload or download

In the BASIC program area type "List" but <u>do not press the "Enter" key</u>. After setting up the programmer for an ASCII file receive, switch back to the RTU and press the "Enter" key and the file will be captured on the computer.

To send a computer file to the RTU, first clear the program in the unit by typing "New" and press "Enter". Use the ASCII file transfer to send the file from the computer to the RTU.

The text file will be sent directly to the BASIC area. The file must then be saved to a <u>local</u> file for permanent storage and for automatic startup, etc. To save a file locally, type "Save 11" or "Save 12" through "Save 19".

Basic program files that have been saved can be manually recalled for operation by entering: "New", then "Load nn", where nn is the file number (11 - 19).

2.3 BASIC Applications / Calculations

Simple BASIC programs have complete access to Table 1 and Table 2 registers, as well as historical and summary data.

In some cases, it is more convenient to write a BASIC program for complex mathematical conversions, or for specialized control algorithms.

This powerful capability allows a complete range of application specific functions to be added on an as needed basis or customized on a per job basis.

Math functions include trigonometric, exponential and logarithmic functions. Integer and single precision floating point types are supported. Bitwise boolean functions allow easy manipulation of digital points.

See the BASIC section for information on programming and "standard application" programs.

2.4 Autoexec Startup of a BASIC Program

Setting DIP SW1 to the down position will cause BASIC program file 11 (first file in file device 10) to automatically load and execute at startup. (similar to a LOAD 11)

If battery backed operation is not available, this is important if a BASIC program is to be utilized for online control purposes.

Autoexec loads the program file and executes it in the NOERROR mode. It is important that this program be error free before using it for Autoexec purposes.

2.5 Dial-Up Modem Functions

Dial modem access can be via the internal dial modem option or via an external modem connected to one of the serial ports.

The internal dial modem is patterned after most smart modems and has a subset of the "Hayes" modem commands. Commands include both dial and auto-answer functions.

The user may manually initiate a dial connection or the modem can be controlled by a BASIC program.

A BASIC program can access the station name and the alarm dialout phone number strings by using FILE 9 to read these strings. selection of whch string to read is made by writing a single ASCII digit to FILE 9, followed by a read from FILE 9 until a carriage return ("cr") terminating character is read.

Selection of station name is made by writing a "0" to FILE 9. Selection of phone numbers (1-6) is made by writing the phone number string desired "1" through "6".

2.6 Maintenance Monitor / Diagnostics

2.6.1 Verifying Micro-processor Running

If a unit has failed and shows no signs of life, a quick way to verify power is to reset the unit by removing and then restoring power. When power is restored, the front panel LED's (1 - 4) should light up briefly before shutting off and proceeding to their on-line functions. If there is no indication of the LED's lighting momentarily, power is not being supplied to the unit, the internal fuse has blown, or the internal power supply has failed.

If the unit does not startup or appear to be running normally, the monitor can be used to verify if the unit is basically functional (i.e., the processor and memory are operational).

If the unit will not start up in monitor mode and interact via port 0, then the unit must be returned to the factory for repair.

The monitor can run simple memory tests on selected portions of memory and can exercise basic I/O functions (to the LED's for example) as a means of isolating a failure.

2.6.2 Manually Keying Transmit

Occasionally it is desirable to manually key the transmitter to test levels or otherwise verify a communications path. This can be accomplished for the Bell 202 modem option either by installing a jumper on JP5-1,2 (external jumper 5, pins 1 & 2, on front left of SM805), or by entering the following commands (in the monitor mode):

For manual "ON"   OE004,6 "carriage return"

For manual "OFF"   OE004,0 "carriage return"

2.6.3 Offline maintenance monitor

An offline maintenance monitor is included in the unit that provides a number of maintenance type functions. It is intended only for experienced service personnel.

The monitor can be entered by inserting the shorting plug on JP5 1,2 (external jumper 5, pins 1 & 2, on front left of SM805), and resetting the unit by disconnecting power momentarily. Any power-up start with this jumper installed will take you to the monitor instead of to the normal online system.

The monitor will automatically output an initial identification message to "port 0" at 9600 baud. A list of available commands can be displayed by entering a "?" and a carriage return (or "enter").

2.7 Cross Reference for Register Addressing

(See next page)

NBT RA-PLC Series 805	Table 1 - Bits Rows 1 - 179	Table 1 - Integers Rows 1 - 179	Table 2 - Bits Registers 0 - 913	Table 2 - Integers Registers 0 - 913
Standard MODBUS Protocol	***Input Status*** *(read only)*	***Input Registers*** *(read only)*	***Coils*** *(read/write bits 0-7)*	***Holding Registers*** *(read/write)*
NBT DDE Driver	"T" + row (as four digits) + ":" + bit T0001:1 = row 1, bit 1	"T" + row (as four digits) (read/write) ③ T0001 = row 1	"R" + register (as four digits) + ":" + bit R0091:1 = reg 91, bit 1	"R" + register (as four digits) ③ R0082 = reg 82
NBT DDE Driver 800 Series High/Low Limit Extensions		"H" + row (as four digits) "L" + row (as four digits) (read/write) ③ H0001 = row 1 Hi Limit		
Wonderware MODBUS	10,001 + (row *8) 10,025 = row 3, digital	30,001 + row ① 30,050 = row 49, analog	(register * 8) + 1 + bit ② 402 = reg 50, bit 1	40,001 + register ① 40,0031 = reg 30
Skyhawk MODBUS	(row + 1) * 8 Type IS 16 = row 1, digital	row + 1 Type IR 2 = row 1, analog	(register * 8) + 1 + bit Type C 116 = reg 14, bit 3	register + 1 Type HR 25 = reg 24

① Wonderware address must be followed by a space and the letter "S" to indicate signed register or they will be read as unsigned values.

② Wonderware allows bit addressing using a register and offset (ie 40001:3) for Table 2 but this is a read-only function.

③ Using the NBT driver, registers may be read as unsigned by placing a space and a "U" after the address.

2.7.1 Extended Register Access- ModBus Addressing (for Keypads)

Table 1 Current Values (read only)	30001 + Line #
Table 1 Current Value (read/write)	46501 + Line #
Table 1 High Limit (read/write)	46001 + Line #
Table 1 Low Limit (read/write)	47001 + Line #
Table 2 Reg. Bits (read/write)	(register*8)+1 + bit *note:* 8 bits per register
Table 2 Registers (read/write)	40001+ Register

2.8 PC Based Utility Programs

2.8.1 Historical File Conversion - History.exe

"History.exe" is a PC based program which will translate a historical data dump file which has been downloaded to the PC to either or LOTUS (CSV) or TEXT format.

2.8.2 RENUM - BASIC Program File Renumber Utility

This utility allows a Basic program to be renumbered. Some or all of the program may be renumbered.

Command Line Usage:

RENUM filename [-Fn][-Ln][-Sn][-In]

where: n is a line number;   F=First, L=Last, S=Start (new #), I=Incr