

ROMET Communication Protocol

1. Overview

The communication between the ROMETLink and the ROMET Unit are,

- ❑ Use a **Serial Port** (RS232/RS485).
- ❑ Use **7 Special ASCII Chars** for special purposes.
- ❑ Adopt **CRC16-CCITT** Algorithm to calculate the Error Check Code.
- ❑ The ROMETLink initiates the communication request by sending the **Pre-defined and/or Packet Command** and the ROMET Unit responds this command by returning the **Pre-defined and/or Packet Message**.

During communication with the ROMETLink, the ROMET Unit has the following behavior.

- ❑ Does not respond to any keypad stroke.
- ❑ Displays “LINKED” to indicate the operation mode on LCD.

So, the communication operation mode prohibits the ROMET Unit from switching to any other operation mode besides the normal operation mode, refer to the ROMET documents for more information about the ROMET Unit operation modes.

In addition, only in the normal operation mode, the ROMET Unit can respond the Link Establishing Command to establish the link with the ROMETLink. In any other operation mode, the ROMET Unit does not send any message to respond the Link Establishing Command and any other communication command. In other words, if the ROMET Unit works in any other operation mode, except the normal operation mode, its communication function is prohibited.

2. Serial Port Settings

The following table lists the Serial Port Settings.

Baud Rate	9600
Data Bits	8
Parity Bit	None
Stop Bits	1

3. 7 Special ASCII Chars

Among the transferred command and message, 7 special ASCII Chars are used for the special purposes. The following table shows these chars.

Char Name	Hexadecimal Value	Text (Display) Appearance	Purpose
SOH	01		The start char.
STX	02		The first delimiter.
ETX	03		The second delimiter, separate the data from the followed CRC code.
EOT	04		The stop char.
ENQ	05		Enquiry char sent by the ROMETLink at the beginning of establishing link.
ACK	06		(1) The Acknowledge char returned by the Unit at the beginning of establishing link. (2) The Continue downloading char sent by the ROMETLink when downloading the Audit Trail records. ^{#3}
RS	1E		The stop char in the non-last Audit Trail record. ^{#3}

Note:

#3: When downloading Audit Trail/Daily Log records, the ROMET Unit returns records with RS (1E) or EOT (04) as the stop char.

- RS (1E), this means there are more record(s) in the Unit's Audit Trail memory.
- EOT (04), this means this record is the last.

So, if the returned record with RS as the stop char, the ROMETLink should send ACK (06) to ask continue downloading more records until the returned record with EOT as the stop char. Refer to the Sections about Audit Trail and Daily Log downloading.

4. CRC16-CCITT Algorithm

Both the ROMETLink and the ROMET Unit use CRC16-CCITT (CCITT Cyclic Redundancy Check) Algorithm to calculate the Error Check Code with the following conditions.

- ❑ Initial value: 0.
- ❑ Polynomial: $X^{16} + X^{12} + X^5 + 1$.
- ❑ Chars are involved in the calculation:
 - If the message has SOH (01) as the start char, excluding this start char, all other transferred chars are involved in the calculation. Take the message " RD 127" as an example, the last 7 chars, excluding the first start char " ", are included in the calculation.
 - On the contrary, if the message does not have the start char SOH (01), all transferred chars are included in the calculation. For example, the second returned Audit Trail record, 032498,081829....., which is sent by the ROMET Unit during the Audit Trail records downloading, does not have the start char, so all transferred chars are included in the calculation. Refer to the Audit Trail Downloading Return Message for more detail about the Audit Trail record's format.
- ❑ Process chars in the same sequence as transferring. Also take the message " RD 127" as an example, the processing sequence is R→D→ →1→2→7→ .

The following C code implements this Algorithm:

```
int i;
int Length;           //The length of the Message
int StartPos;         //The starting position
unsigned int input[200]; //Value of each char among the Message
unsigned int crc;      //Generated CRC code

crc = 0x0;           //Initial Value
StartPos = 0; //has not the start char
if (input[0] == 1)    StartPos = 1; //has the start char

for (i = StartPos; i <= Length; i++) //loop for each char
{
    crc = (unsigned char) (crc >> 8) | (crc << 8);
    crc ^= input[i];
    crc ^= (unsigned char) (crc & 0xff) >> 4;
    crc ^= (crc << 8) << 4;
    crc ^= ((crc & 0xff) << 4) << 1;
}
```

Note: It is best not to alter this code. For example, `(crc << 8) << 4` does not generate the same code as `crc << 12`. Although the result of the computation is the same, the latter generates much more code and executes slower.

5. Pre-defined Command and Pre-defined Message

The ROMETLink initiates some kinds of communication requests by transmitting the designated Pre-defined Command. In turn, the ROMET Unit responds some kinds of communication requests by returning the proper Pre-define Message. All Pre-defined Commands and Pre-defined Messages have the format as Figure 5-1 shown.

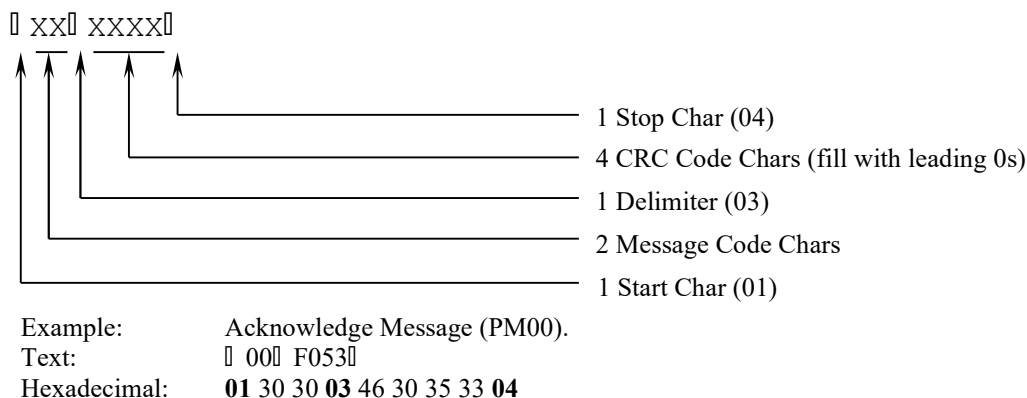


Figure 5-1. Pre-defined Command and Pre-defined Message Format

In this section, the description has **text Appearance (Hexadecimal value)** convention and the abbreviation of the Pre-defined Command and Pre-defined Message, such as PM00, PM01, will be referred in the followed sections.

5.1 Pre-defined Command transmitted by the ROMETLink

- ❑ Disconnect Link Command (PMSF)
//SF//9097// (01 53 46 03 39 30 39 37 04)
- ❑ Read Site Name and Address Command (PMRS)
//RS//5B21// (01 52 53 03 35 42 32 31 04)
- ❑ Shut Down Command (PMES)
//ES//9DD2// (01 45 53 03 39 44 44 32 04)

5.2 Pre-defined Message transmitted by the ROMET Unit

- ❑ Acknowledge Message (PM00)
//00//F053// (01 30 30 03 46 30 35 33 04)
- ❑ Format Error Message (PM01)
//01//C362// (01 30 31 03 43 33 36 32 04)
- ❑ Sign On Message (PM20)
//20//9E33// (01 32 30 03 39 45 33 33 04)
- ❑ Time Out Error Message (PM21)
//21//AD02// (01 32 31 03 41 44 30 32 04)
- ❑ Frame Error Message (PM22)
//22//F851// (01 32 32 03 46 38 35 31 04)
- ❑ CRC Error Message (PM23)
//23//CB60// (01 32 33 03 43 42 36 30 04)
- ❑ Incorrect Instrument Access Code Message (PM27)
//27//07A4// (01 32 37 03 30 37 41 34 04)
- ❑ Incorrect Command Code Message (PM28)
//28//179A// (01 32 38 03 31 37 39 41 04)
- ❑ Incorrect Item Number Message (PM29)

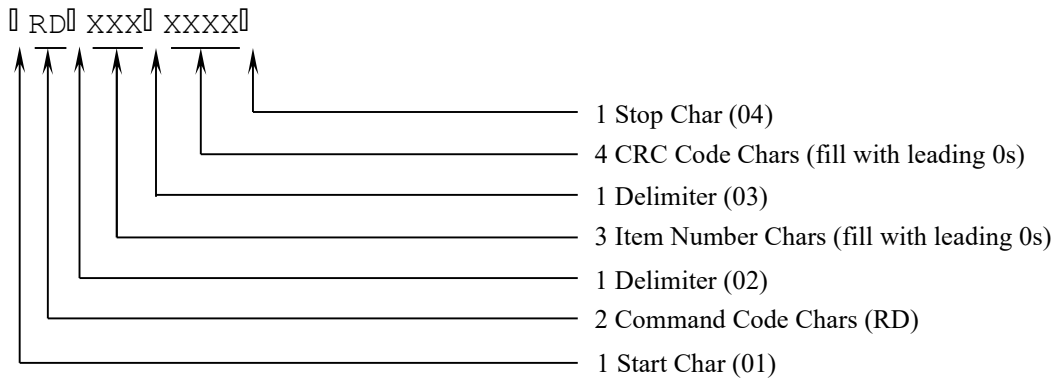
- //29//24AB// (01 32 39 03 32 34 41 42 04)**
- ❑ Invalid Enquiry Message (**PM30**)
//30//A903// (01 33 30 03 41 39 30 33 04)
 - ❑ Too Many Audit Trail Requests Message (**PM31**)
//31//9A32// (01 33 31 03 39 41 33 32 04)
 - ❑ Unit is in READ ONLY Mode Message (**PM32**)
//32//CF61// (01 33 32 03 43 46 36 31 04)

5. Packet Command and Packet Message

6.1 Packet Command Transmitted by the ROMETLink

6.1.1 Item Reading Command

When reading item from the Unit, the ROMETLink sends the Item Reading Command. The figure 6-1 shows the format of this Reading Command.



Note:

Command Code: RD.

Item Number: any legal ROMET Item Number (000 – 332).

Example: Read the Item 127 from the Unit.

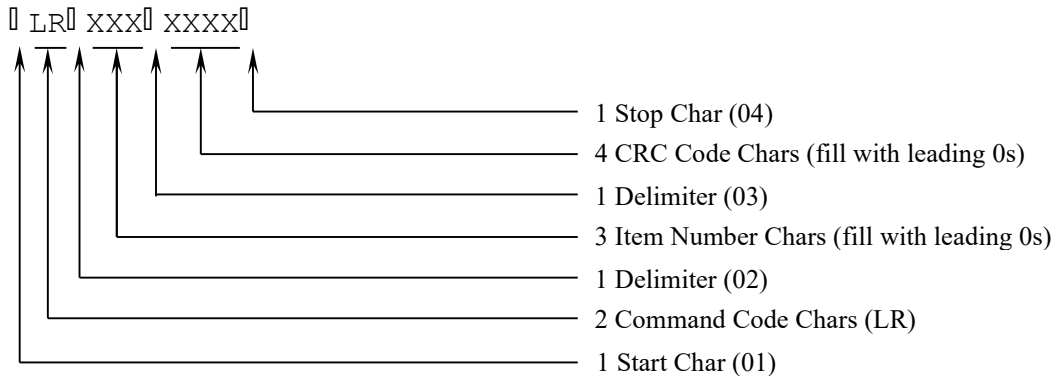
Text: ⌈ RD⌈ 127⌈ FFBF⌈

Hexadecimal: 01 52 44 02 31 32 37 03 46 46 42 46 04

Figure 6-1. Item Reading Command Format

6.1.2 Calibration Reading Command (**Obsolete, use the item reading command**)

When the Unit performing Pressure or Temperature Calibration via the ROMETLink, the ROMETLink sends the Calibration Reading Command. The figure 6-2 shows its format.



Note:

Command Code: LR.

Item Number: 008 – Gas Pressure and 026 – Gas Temperature.

Example: Read the dynamic Pressure from the Unit.

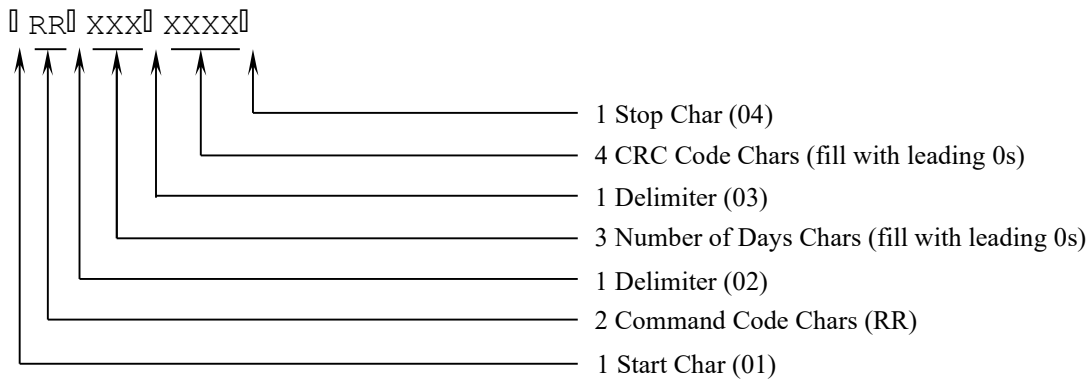
Text: ⌈ LR⌈ 008⌈ 65C3⌈

Hexadecimal: 01 4C 52 02 30 30 38 03 36 35 43 33 04

Figure 6-2. Calibration Reading Command Format

6.1.3 Audit Trail Downloading Command (Old command, refer to #2 for new command)

When downloading Audit Trail records from the ROMET Unit, the ROMETLink sends the Audit Trail Downloading Command to initiate the downloading of the first Audit Trail record. Its format is shown as the figure 6-3.



Note:

Command Code: RR.

Number of Days: 001 – 041, 112. The number of days of records to be downloaded (Max. 41 days). 112 means to download the entire records.

Example: Download Audit Trail records of the past 8 days.

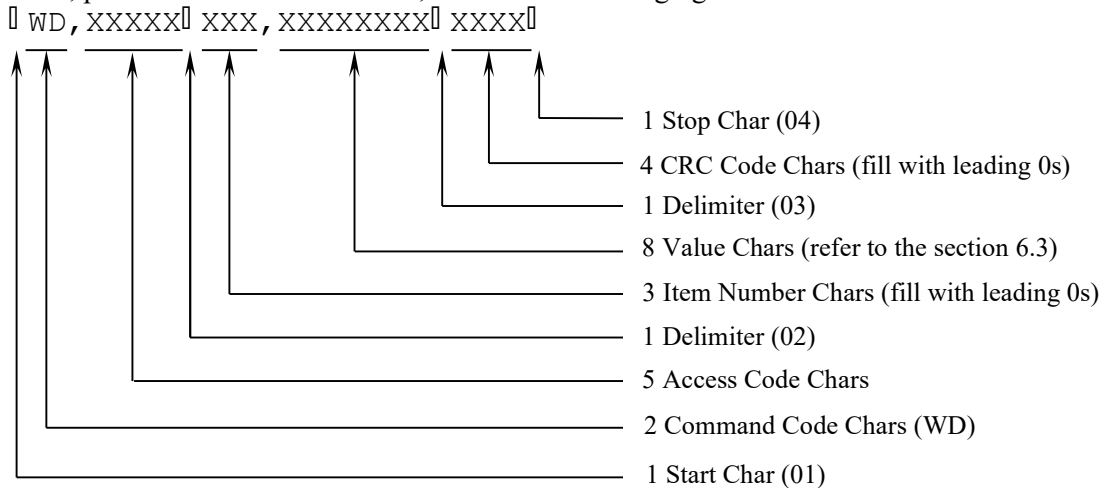
Text: ␣ RR␣ 008␣ 6030␣

Hexadecimal: 01 52 52 02 30 30 38 03 36 30 33 30 04

Figure 6-3. Audit Trail Downloading Command Format

6.1.4 Item Writing Command

When writing value to the Unit, the ROMETLink sends the Item Writing Command. The figure 6-4 shows the format of Item Writing Command. For more information about the Unit Access Code, please refer the section 6.1.5, Access Code Changing Command.



Note:

Command Code: WD.

Access Code: the Unit Access Code. The default value is 33333.

Item Number: any legal ROMET Item Number (000 – 332).

Example: Write 1 to the Item 089.

Text: ␣ WD,33333␣ 089, 1␣ DF77␣

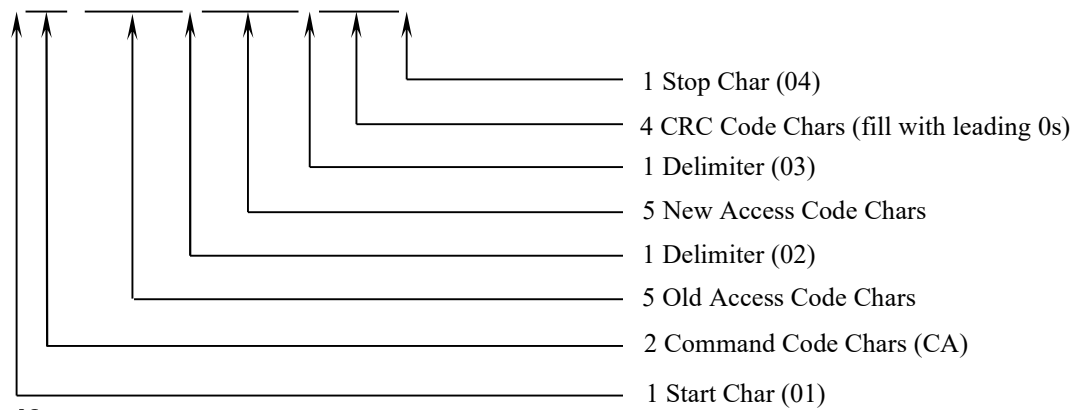
Hexadecimal: 01 57 44 2C 33 33 33 33 02 30 38 39 2C 20 20 20 20 20 20 20 20 31 03 44 46 37 37 04

Figure 6-4. Item Writing Command Format

6.1.5 Access Code Changing Command

Each ROMET Unit has a 5-digit Access Code, which default value is 33333. When the user wants to establish the link with the Unit via the ROMETLink, this Access Code must be entered. The user can also change the Access Code by sending the Access Code Changing Command to the Unit. The format of this command is shown as the figure 6-5.

⌈ CA, XXXXX⌋ XXXXX⌋ XXXX⌋



Note:

Command Code: CA.

Access Code: the Unit Access Code. The default value is 33333.

Example: change the Access Code form 33333 to 55555.

Text: ⌈ CA,33333⌋ 55555⌋ 7D29⌋

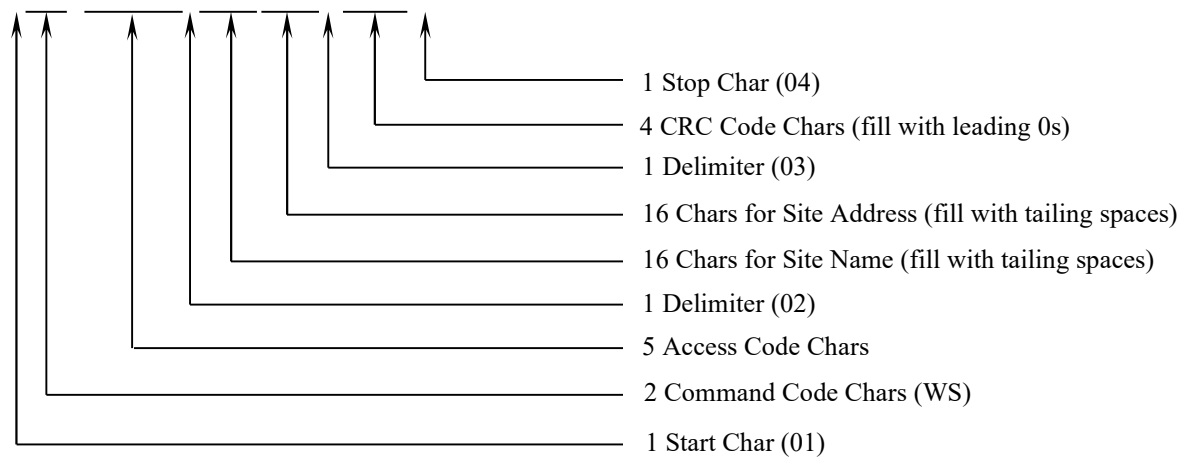
Hexadecimal: 01 43 41 2C 33 33 33 33 33 02 35 35 35 35 35 03 37 44 32 39 04

Figure 6-5. Access Code Changing Command Format

6.1.6 Site Name and Address Changing Command

Each ROMET Unit has both the Site Name and Address, which default values are nulls. The user can change the Site Name and Address by sending the Site Name and Address Changing Command, which format is shown as the figure 6-6.

⌈ WS, XXXXX⌋ X...XX...X⌋ XXXX⌋



Note:

Command Code: WS.

Access Code: the Unit Access Code. The default value is 33333.

Example: change the Site Name to ROMET and the Site Address to SITE ID PART 2.

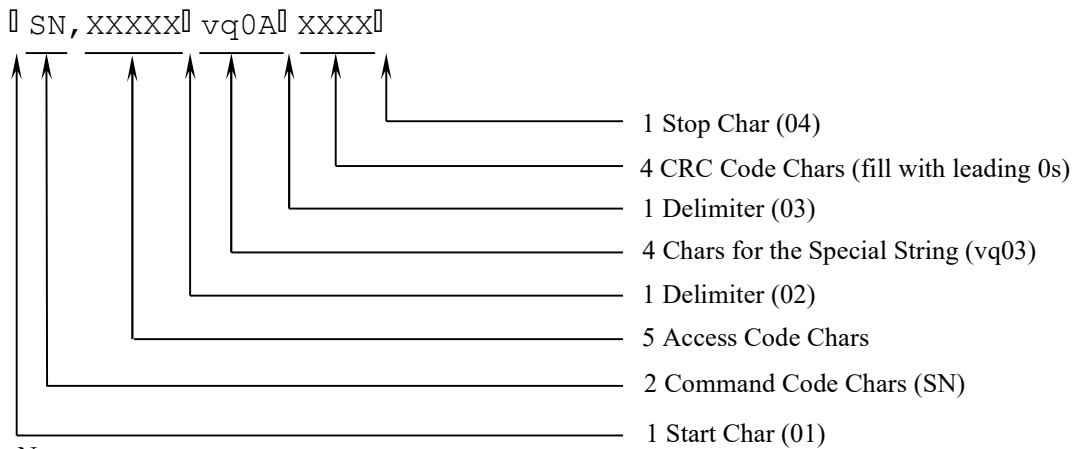
Text: ⌈ WS,33333 ROMET MISSISSAUGA88 ⌋ A9FE⌋

Hexadecimal: 01 57 53 2C 33 33 33 33 33 02 52 4F 4D 45 54 20 03 41 39 46 45 04

Figure 6-6. Site Name and Address Changing Command Format

6.1.7 Link Establishing Command

The ROMETLink sends Link Establishing Command to establish the link with the ROMET Unit before transferring any data via the link. The figure 6-7 and show the formats of these two Commands.



Note:

Command Code: SN.

Access Code: the Unit Access Code. The default value is 33333.

Special String: must be vq0A.

Example: Link Establishing Command 1 with the Access Code is 33333.

Text: ⌈ SN,33333⌋ vq0A⌋ XXXX⌋

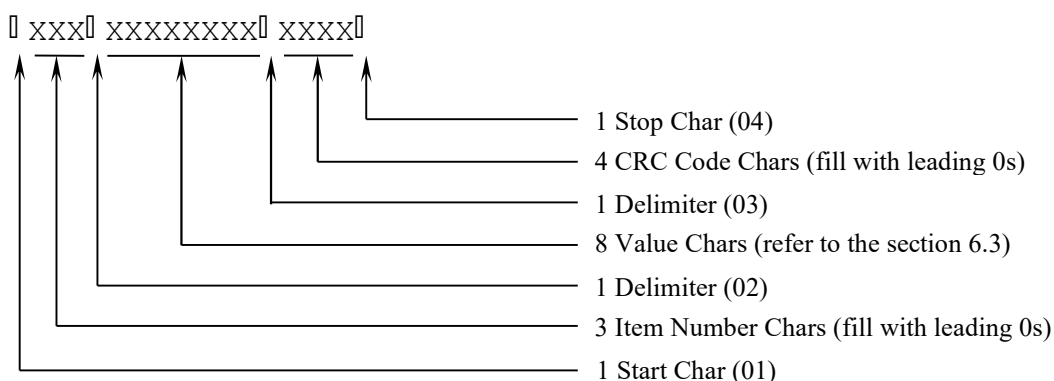
Hexadecimal: **01 53 4E 2C 33 33 33 33 33 02 76 71 30 33 03 XX XX XX XX 04**

Figure 6-7. Link Establishing Command

6.2 Packet Message Transmitted by the ROMET Unit

6.2.1 Reading Return Message

After receiving the Item Reading Command, the Unit sends the Reading Return Message based on the item number specified by the received command. The figure 6-9 shows the format of such Message.



Note:

Item Code: any legal ROMET Item Number (000 – 332).

Example: Return Message on responding to reading the Item 127 request.

Text: [127] [3] 7726 [(The value of the Item 127 is 3).]

Hexadecimal: 01 31 32 37 02 20 20 20 20 20 20 20 33 03 37 37 32 36 04

Figure 6-9. Reading Return Message Format

6.2.2 Audit Trail Downloading Return Message (old format and refer to protocol #2)

The format of the Audit Trail Downloading Return Message, sent by the ROMET Unit on responding to downloading the Audit Trail records request, is a little complex. As the figure 6-10

[F1, F2, F3, F4, F5, F6, F7, F8, F9, F10, F11, F12, F13] F14

Figure 6-10. Audit Trail Downloading Return Message Format

shows, this message is comprised of 14 fields from F1 to F14. Each field's meaning is shown in the following table (please check the message shown in the figure 7-6, Audit Trail Downloading Flow Chart, as an example).

Field	Meaning	Referenced ROMET Item Number	Width (Char)	Format	Optional
F1	Record Logged Date	204	6	MMDDYY	No
F2	Record Logged Time	203	6	hhmmss	No
F3	Incremental Corrected Volume	225	8	Fill with leading 0s	No
F4	Incremental Uncorrected Volume	226	8	Fill with leading 0s	No
F5	Average Pressure	206	8	Fill with leading spaces	No
F6	Average Temperature	207	8	Fill with leading spaces	No
F7 ~ F12	Optional Items Selected for Downloading	229 ~ 234	8	Refer to the Section 6.3	Yes
F13	Record Trigger and Alarm Word	N/A	4	#4	No
F14	CRC Code	N/A	4	Fill with leading 0s	No

Note:

#4: Record Trigger and Alarm Word is 4-char-width field, and its value is 16-bit (1-word) length. This 16-bit value's format is shown as the figure 6-11.

Bit:15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00
Trigger Code			Alarm 71	Alarm 70	Alarm 69	Alarm 222	Alarm 107	Alarm 106	Alarm 105	Alarm 104	Alarm 103	Alarm 102	Alarm 101	Alarm 100	Alarm 99

Figure 6-11. Record Trigger and Alarm Word Format

As the figure 6-11 shows, the Record Trigger and Alarm Word can be split up to 2 parts.

- Part 1: Trigger Code. Trigger Code indicates what cases the record to log in the Audit Trail memory. According to the ROMET documents, 11 kinds of record triggers are available for the ROMET Unit (please refer the ROMET Item Number 173 ~ 175, and 235 ~ 242), but the 3-bit Trigger Code only supports $2^3 = 8$ kinds of record triggers. The following table shows each kind of record trigger and its corresponding Trigger Code.

Trigger	Trigger Legend	Trigger Code (3-bit)	Item Number
Audit Trail Time Intervals	TIME	000	235
Daily Nominated Volume Reached	VOLUME	001	236
Alarm Activation	ALARM	010	237
Serial Access	DCU	011	238
Meter Reader (Mag Wand) Access	MAG READ	100	239
Calibration Access (11111)	CALIB	101	240
Configuration Access (22222)	CONFIG	110	241
Change Made Via Keypad	CHANGE	111	242
Hardware Reset of the Microprocessor	RESET	Unknown ^{#5}	173
Alarm Successfully Cleared	CLR ALM	001 ^{#5}	174
Instrument Shutdown	SHUTDN	Unknown ^{#5}	175

Note:

#5: These 3 kinds of record triggers may not be supported in this ROMET firmware. But during testing, after clear any kind of alarm, one VOLUME triggered record is logged in the Audit Trail memory. So both CLR ALM and VOLUME triggers maybe use the same Trigger Code (001). This maybe one bug in the ROMET Unit.

- Part 2: Alarm Bits. Bit 0 to bit 12 are alarm bits. Each bit corresponds to one kind of alarm source (the ROMET Unit has 13 kinds of alarm sources, item number 69 ~ 71, 99 ~ 107, and 222). If one kind of alarm is detected, one ALARM triggered record, with the corresponding alarm bit setting to 1, is logged in the Audit Trail memory. (But the Alarm 105, Alarm 106, and Alarm 107 must be places in the Item 72, Item 73, or Item 74 before they can trigger an ALARM record and set the alarm bit 6, alarm bit 7, and alarm bit 8, respectively, please refer to the ROMET documents).

Here gives two examples about the Field 13 (suffix B – Binary, suffix H – Hexadecimal).

- Detect the Memory Battery Low Alarm (Alarm 101).
In this case, F13 = 0100,0000,0000,0100B = 4004H. The value of the first 3-bit (010B) means this is an ALARM triggered record, and the value of the last 13-bit (0,0000,0000,0100B) means that the Alarm 101 is detected.
- Configuration Access (the user enters 22222 as the Access Code via the keypad) with the Pulse A Over Limit Alarm (Alarm 69) and Pulse C Over Limit Alarm (Alarm 71).

In this case, F13 = 1101,0100,0000,0000B = D400H. The value of the first 3-bit (110B) means this is a CONFIG triggered record, and the value of the last 13-bit (1,0100,0000,0000B) means that the Alarm 69 and Alarm 71 are set. Note that this is not an ALARM triggered record.

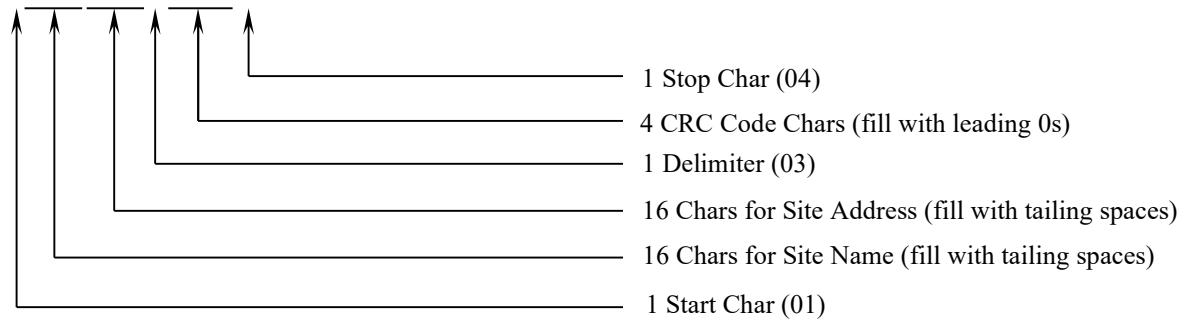
Another important point about the Audit Trail Downloading Return Message is that the returned messages during downloading have different start chars and different stop chars (this is not shown in the figure 6-10).

- ❑ The first record is with SOH (01) as the start char and with RS (1E) as the stop char.
- ❑ The non-first record(s) are without start char(s) and with RS (1E) as stop char(s).
- ❑ The last record is without the start char and with EOT (04) as the stop char.
- ❑ If the first record is also the last record, this record is with SOH (01) as the start char and with EOT (04) as the stop char.

6.2.3 Site Name and Address Reading Return Message

Before changing the Site Name and Address, the ROMETLink reads the current Site Name and Address by sending the Pre-defined Command, Read Site Name and Address Command (PMRS).

⌈ X...XX...X⌋ XXXX⌋



Example: the Site Name is ROMET and the Site Address is MISSISSAUGA88.
Text: ⌈ ROMET MISSISSAUGA88 ⌋ C434⌋
Hexadecimal: 01 52 4F 4D 45 54 20 20 20 20 20 20 20 20 20 20 20 20 20 20 4D 49 53 53 49 53 53 41 55
47 41 38 38 20 20 20 03 43 34 33 34 04

Figure 6-12. Site Name and Address Reading Return Message Format

The ROMET Unit responds this command by transmitting the Site Name and Address Reading Return Message, which format is shown as the figure 6-12.

6.3 Item Value's Format

Among the Item Writing Command, the Item Reading Return Message, and the Audit Trail Downloading Return Message, the designated item's value is transferred. Every transferred item's value is 8-char width, but its format may be different.

In general, the ROMET Unit's items can be grouped into some function groups. For example, the Item 000 (Corrected Volume), the Item 002 (Uncorrected Volume), and all other volume-relevant items can be grouped into the Volume group. The item 120 (Pressure Calibration Date), the Item 199 (Date DD-MM-YY), and all other date-relevant items can be grouped into the Date group. Each item's value in the same group has the same format when transferring it between the ROMETLink and the ROMET Unit or saving it in the Unit's memory. Please refer to the ROMET documents for more information about the Item Numbers and Item Codes definitions.

The following table shows the formats of each item group.

Item Group	Item Number Examples	Format	Format Example	Suggested Saving Type
Volume	000, 001, 002	(1) Fill with leading 0s. (2) Fill with leading spaces.	(1)00088888	Double Word
Energy	140		(2) 88888	
Site Information	200, 201		(It has 3 leading spaces)	
Pulse Output	005, 066			
Date	120, 199	XX-XX-XX	08-18-98	3 Bytes
Time	195	hh mm ss	08 00 00	3 Bytes
Alarm 0 – Not Set 1 – Set	069, 108, 222	(1) Fill with leading 0s if not set. Fill with leading 1s if set. (2) Fill with leading spaces.	(1) 00000000 11111111 (2) 0 1 (They have 7 leading spaces)	1 Bit
Others	018, 032,092	Fill with leading spaces	0.0001 (It has 2 leading spaces)	Dependent

7. Communication Functions Flow Charts

□ □ The Unit must support all following communication functions in order to implement full functional communication with the ROMETLink. Note, for more detail of the Receive OK and 3-Time Retry function blocks in every chart, please refer to the section 8, Communication Error Check.

7.1 Link Establishing (Figure 7-1)

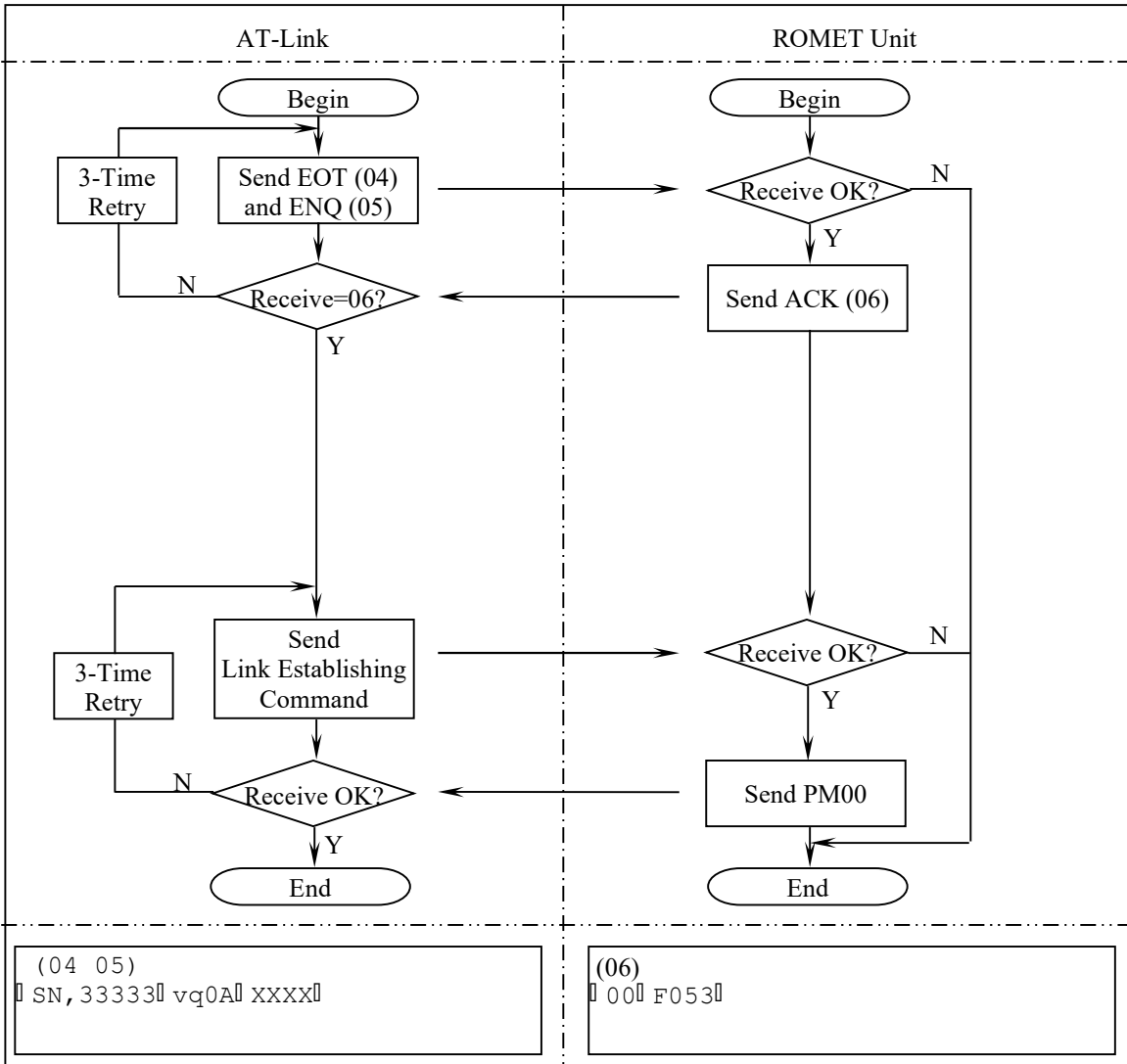


Figure 7-1. Link Establishing Flow Chart

7.2 Link Disconnecting (Figure 7-2)

7.3 Timeout Disconnecting

After 5 ~ 10 minutes timeout period, the ROMET Unit automatically returns to the Not Linked state in order to save power if no more communication request received. Before Timeout

Disconnecting, the ROMET Unit sends **PM23 (Time Out)** message to notify the ROMETLink.

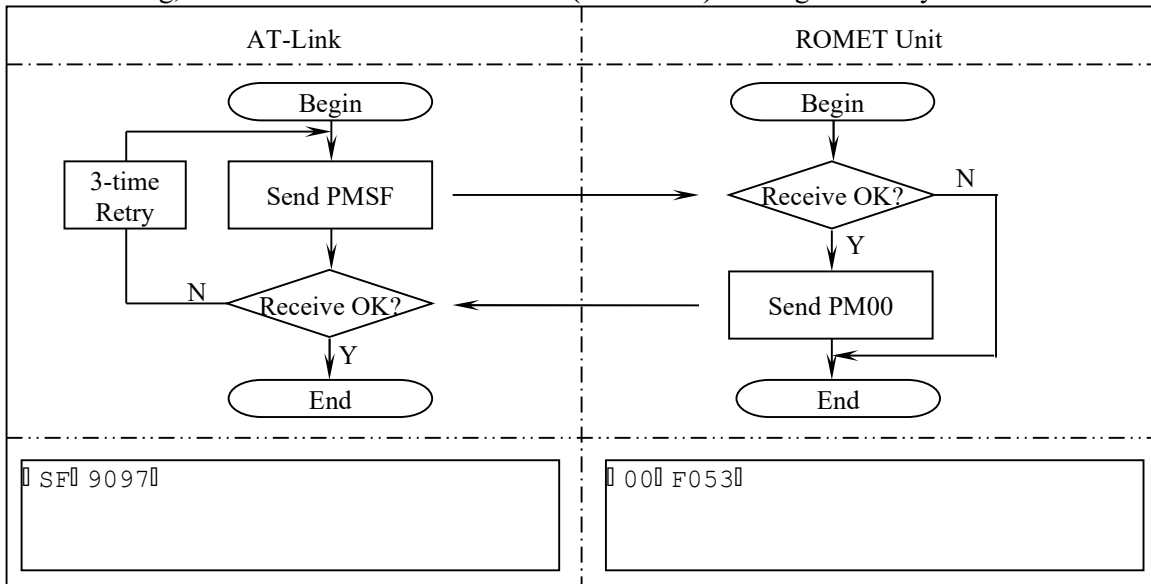


Figure 7-2. Link Disconnecting Flow Chart

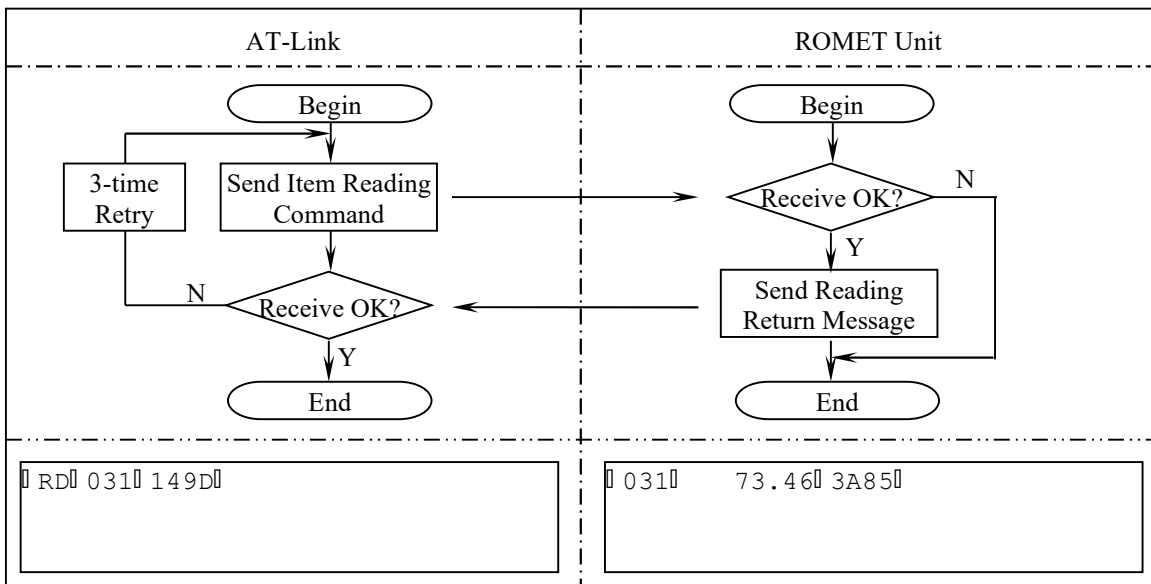


Figure 7-3. Item Reading Flow Chart

This is the only exception to the communication initiates by the ROMETLink.

7.4 Item Reading (Figure 7-3)

7.5 Item Writing (Figure 7-4)

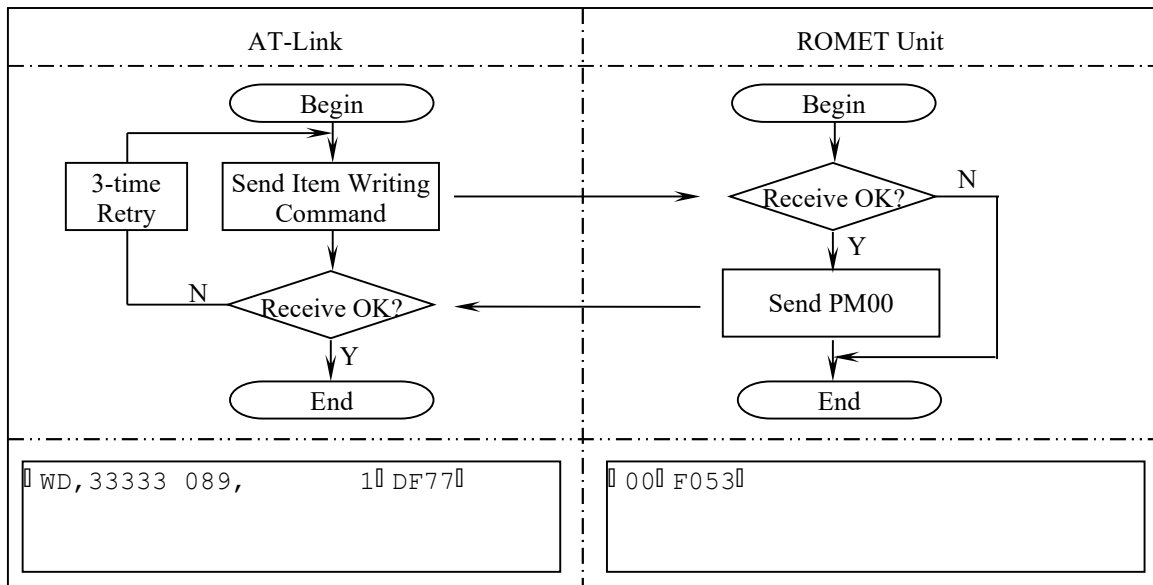


Figure 7-4. Item Writing Flow Chart

7.6 Calibration Reading (Figure 7-5 **Obsolete**)

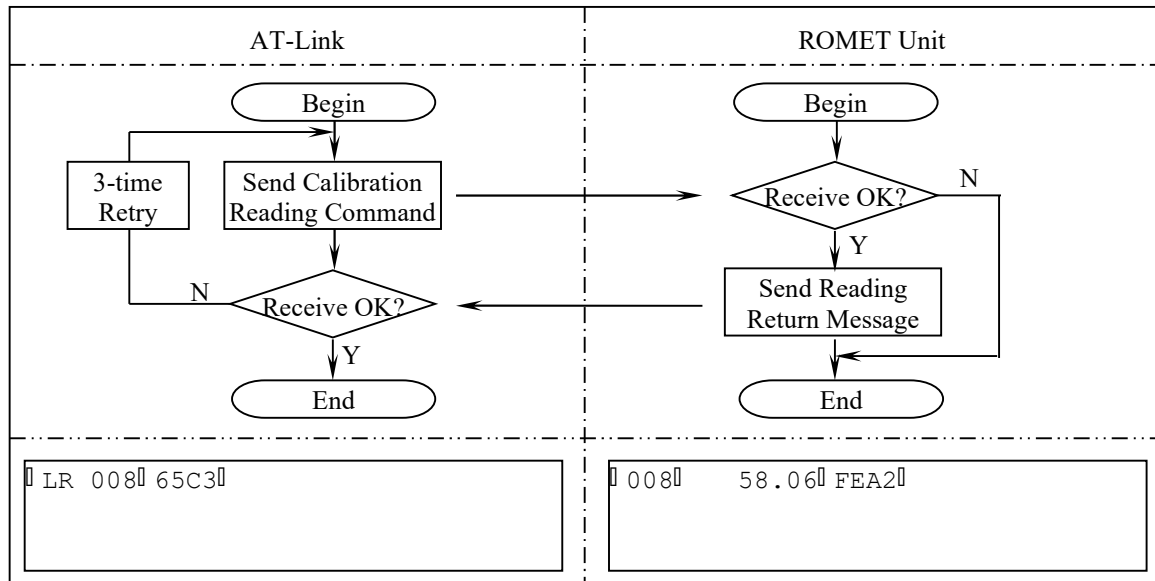


Figure 7-5. Calibration Reading Flow Chart

7.7 Audit Trail Downloading (Figure 7-6, **Obsolete**)

In the example shown as the figure 7-6, the ROMETLink sends the Audit Trail Downloading Command to request 1-day records. The ROMET Unit responds this command by returning the first Audit Trail Downloading Return Message, which has SOH (01) as the start char and RS (1E) as the stop char. After check the stop char in the returned message, the ROMETLink knows that this returned record is not the last, so it sends ACK (06) to ask one more Audit Trail record. The ROMET Unit returns the next Audit Trail Downloading Return Message, which does not have the start char and has EOT (04) as the stop char. After check the stop char in the returned message, the ROMETLink knows that this is the last, so the ROMETLink finishes the downloading procedure at once after receiving this record.

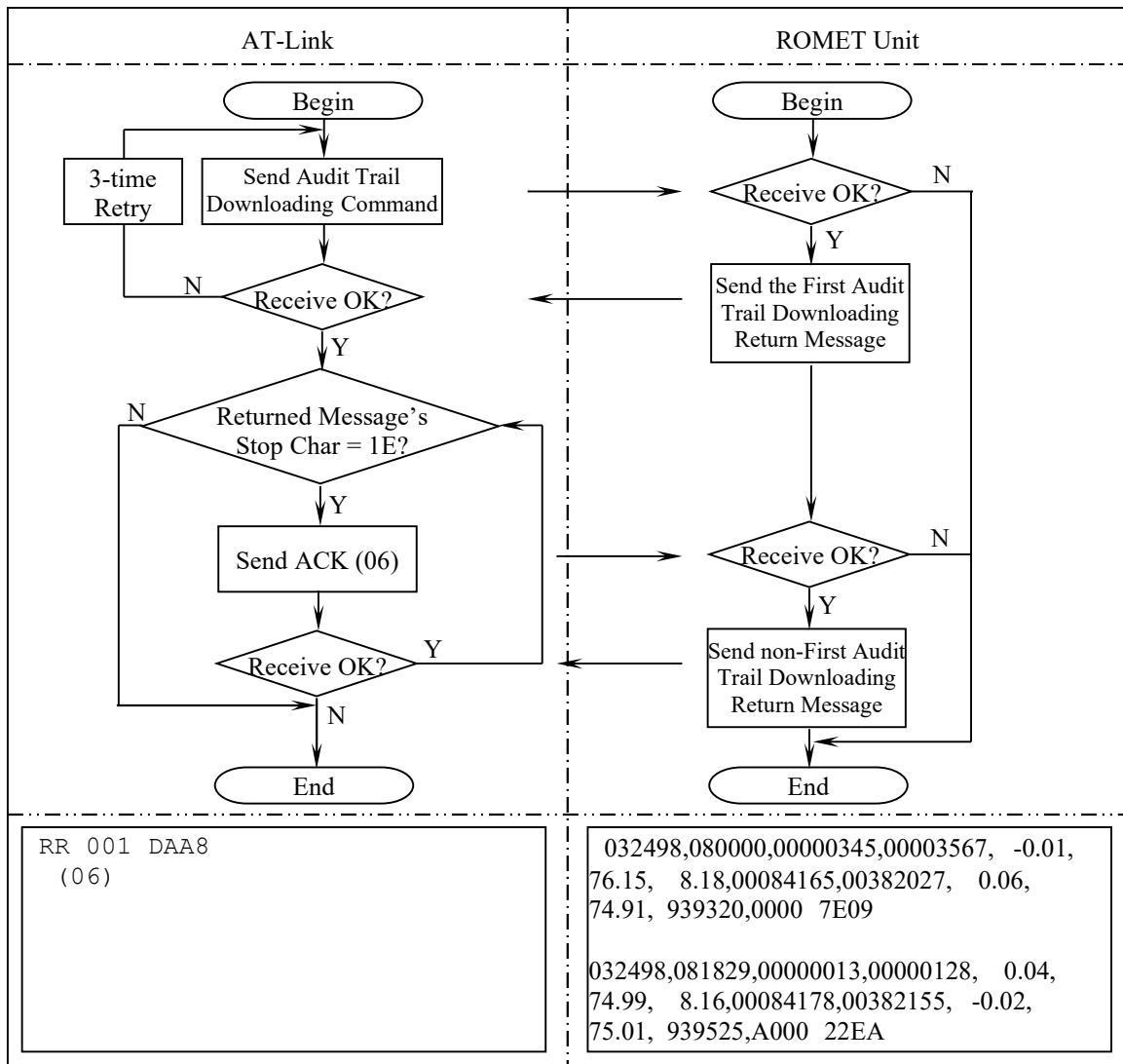


Figure 7-6. Audit Trail Downloading Flow Chart

7.8 Access Code Changing (Figure 7-7)

7.9 Site Name and Address Reading (Figure 7-8)

7.10 Site Name and Address Changing (Figure 7-9)

7.11 Shut Down (Figure 7-10)

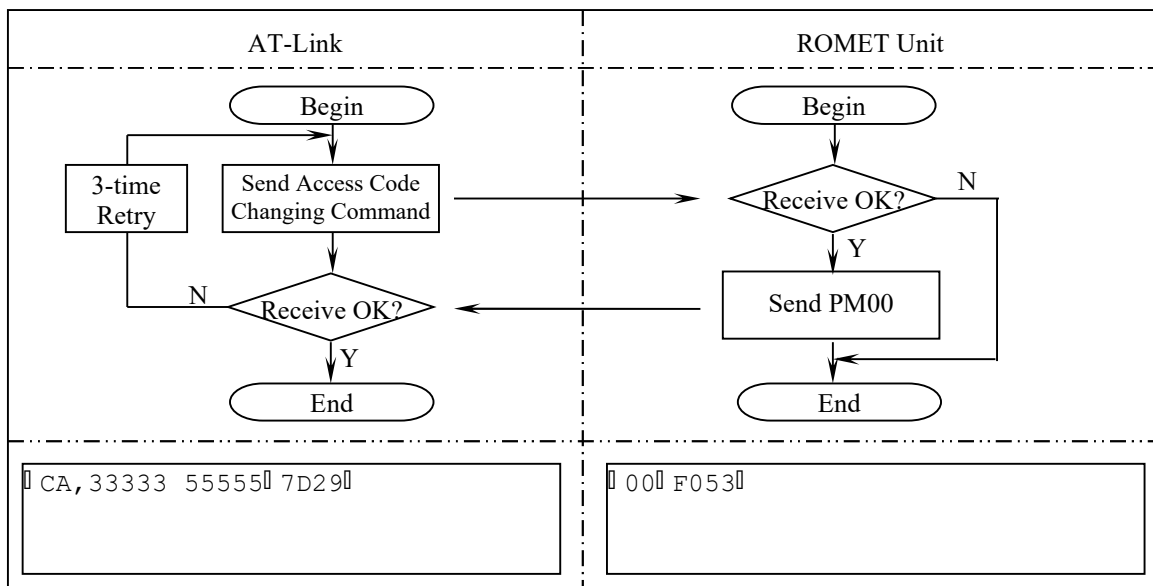


Figure 7-7. Access Code Changing Flow Chart

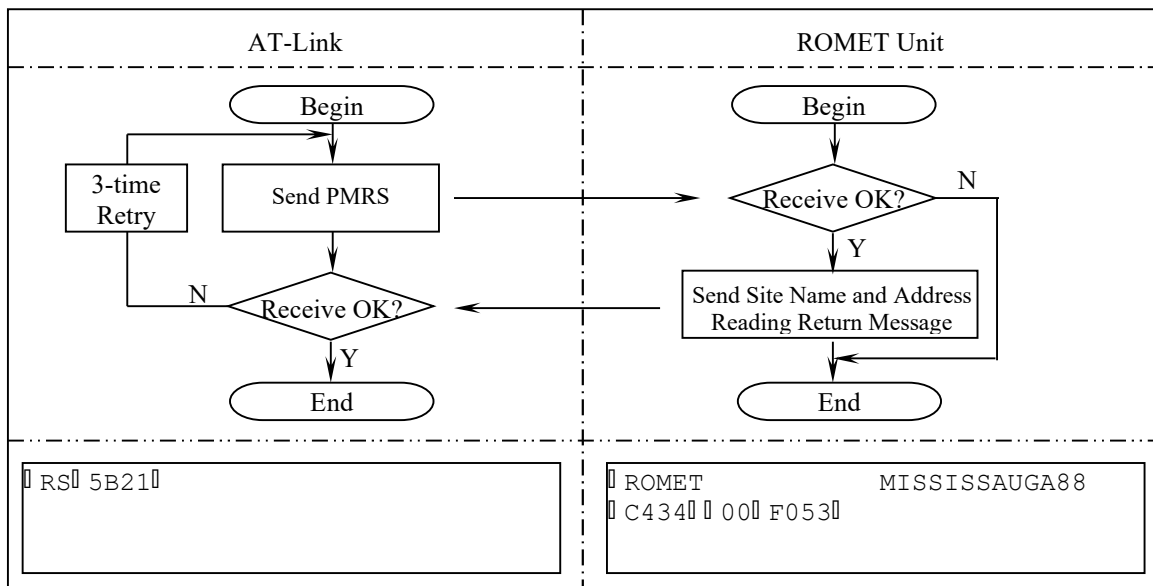


Figure 7-8. Site Name and Address Reading Flow Chart

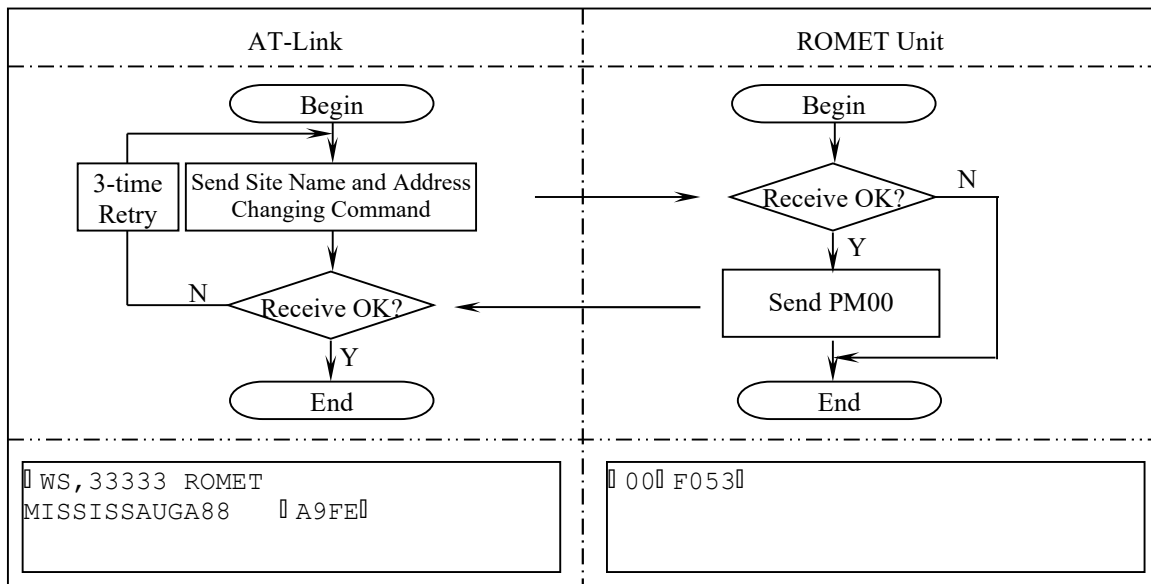


Figure 7-9. Site Name and Address Changing Flow Chart

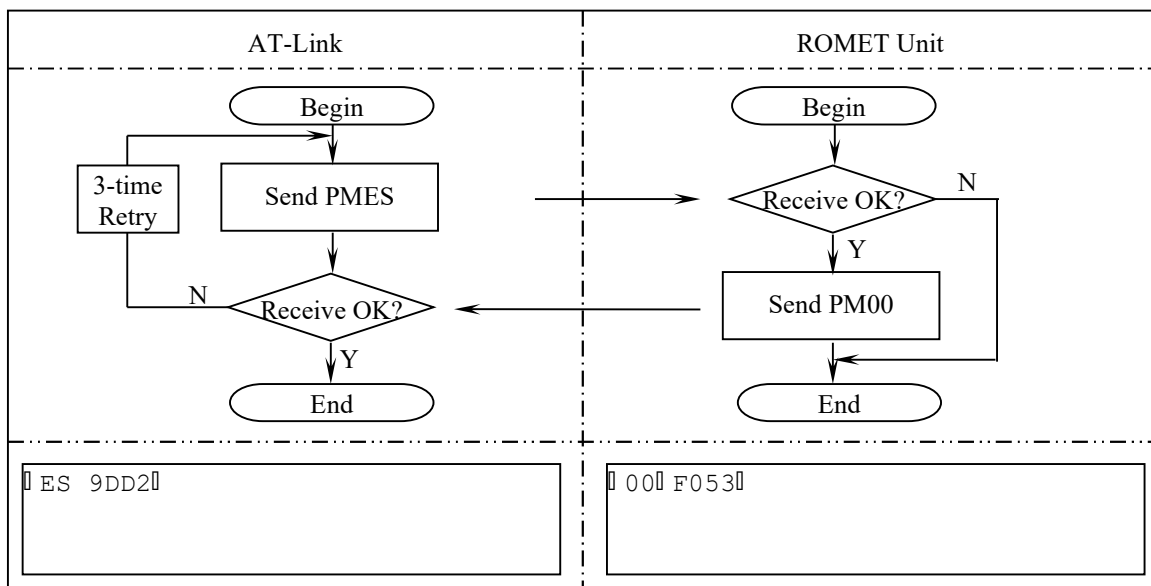


Figure 7-10. Shut Down Flow Chart

8. Communication Error Check

In the section 7, Communication Functions Flow Charts, each flow chart has the Receive OK and 3-Time Retry function blocks. In fact, these blocks refer to the communication error check mechanism of both the ROMETLink and the ROMET Unit.

8.1 Communication Error Check Mechanism of the ROMETLink

8.1.1 Receive OK Function Block of the ROMETLink

The flow chart of Receive OK function block of the ROMETLink is shown as the figure 8-1.

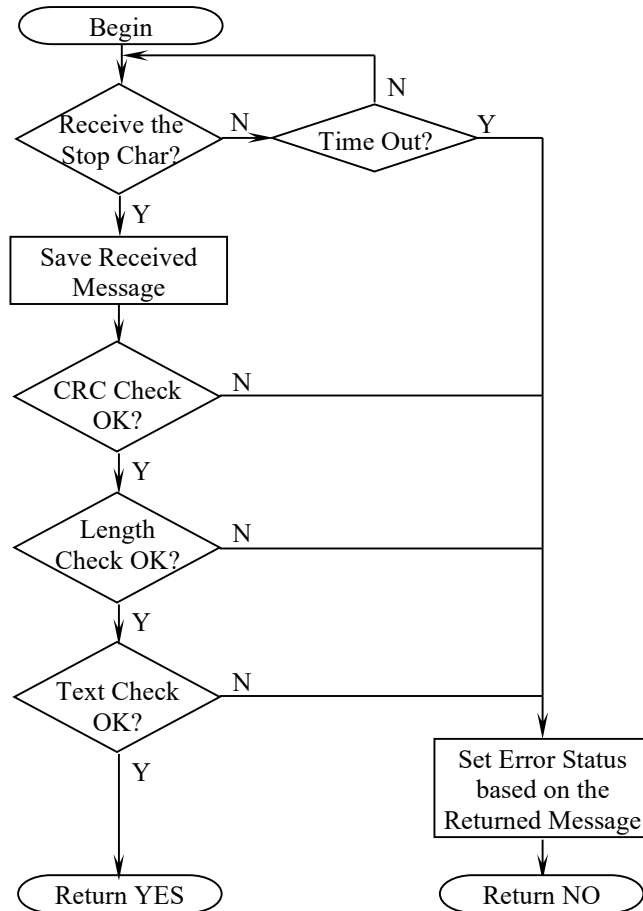


Figure 8-1. Receive OK Function Block of the AT-Link

During receiving returned message from the ROMET Unit, the ROMETLink checks whether the stop char, EOT (04) or RS (1E), is received. If not, check whether the time out period is expired to decide to wait or return. After receiving the stop char, the ROMETLink saves the returned message and performs the following communication error check.

❑ CRC Check

The ROMETLink uses the CRC16-CCITT Algorithm to calculate the CRC Error Code and compares it with the received CRC Error Code.

❑ Length Check

As mentioned in the previous sections, the ROMET Unit responds the communication request by returning the Pre-defined Message and/or Packet Message, and each piece of such

message has fixed length. So the ROMETLink can check whether the returned message has the proper length.

❑ **Text Check**

The ROMETLink checks whether the returned message is the expected message. For example, the ROMETLink wants to read the item 031, so it sends the Item Reading Command, `RD 031 149D`, and the expected return message should be something like `031 XXXXXXXX XXXX`. If the actual returned message is something like `032 XXXXXXXX XXXX`, then Text Check is failure. Another example is the ROMETLink sends `WD,33333 089, 1 DF77` to change the Item 89 to 1, the expected return message is `00 F053`. If the actual returned message is something other than the expected message, then Text Check is failure.

If any kind of error check is failure, the ROMETLink sets the error status based on the returned message in order to display the proper Error Message Window.

8.1.2 3-Time Retry Function Block of the ROMETLink

If the Receive OK function block returns with NO, the ROMETLink retries the communication request by sending the communication command until the Receive OK function block returns with YES or 3-time retry limitation is reached.

8.1.3 Error Message Window Displayed by the ROMETLink

After initiating the communication request and retrying it 3 times, if the received message is not the expected message yet, the ROMETLink displays the proper Error Message Window to indicate what causes the communication error and terminates the communication request.

8.1.3.1 Time Out

- ❑ Situation: cannot receive any (stop) char.
- ❑ Error Message:

Error – Communication timeout on reply from instrument
-- Press <ESC> to continue --

8.1.3.2 CRC Check Failure

- ❑ Situation: receive a message with an incorrect CRC Check Error Code.
- ❑ Error Message:

Error – Incorrect checksum received
-- Press <ESC> to continue --

8.1.3.3 Length Check Failure

- ❑ Situation: receive an incorrect length message.
- ❑ Error Message:

Error – Wrong message length received from instrument
-- Press <ESC> to continue --

8.1.3.4 Wrong Item Number (one kind of Text Check Failure)

- ❑ Situation: receive information about a wrong item number other than the expected.
- ❑ Error Message:

Error – Wrong item number received from instrument
-- Press <ESC> to continue --

- ❑ Example: wants to read the Item 89, but receives the value of the Item 189.

8.1.3.5 Error Reported by the ROMET Unit (another kind of Text Check Failure)

After receiving the communication command sent by the ROMETLink, if the ROMET Unit detects some kinds of communication error or cannot satisfy the communication request, it sends the proper Pre-defined Message other than the expected message. In turn, the ROMETLink displays the proper Error Message Window on receiving such message.

- ❑ on Receiving PM01

Error – Message format error reported by instrument
-- Press <ESC> to continue --

- ❑ on Receiving PM20

Error – Signon error reported by instrument
-- Press <ESC> to continue --

- ❑ on Receiving PM21

Error – Timeout error reported by instrument
-- Press <ESC> to continue --

- ❑ on Receiving PM22

Error – Framing error reported by instrument
-- Press <ESC> to continue --

- ❑ on Receiving PM23

Error – Checksum error reported by instrument
-- Press <ESC> to continue --

- ❑ on Receiving PM27

Error – Incorrect instrument access code. Please re-enter
-- Press <ESC> to continue --

- ❑ on Receiving PM28

Error – Incorrect command code reported by instrument
-- Press <ESC> to continue --

- ❑ on Receiving PM29

Error – Incorrect item number received by instrument
-- Press <ESC> to continue --

- ❑ on Receiving PM30

Error – Invalid enquiry reported by instrument
-- Press <ESC> to continue --

- ❑ on Receiving PM31

Error – Too many Audit Trail requests reported by instrument
-- Press <ESC> to continue --

- ❑ on Receiving PM32

Error – Unit is in READ ONLY Mode
-- Press <ESC> to continue --

8.2 Communication Error Check Mechanism of the ROMET Unit

8.2.1 Receive OK Function Block of the ROMET Unit

The flow chart of Receive OK function block of the ROMET Unit is shown as the figure 8-2.

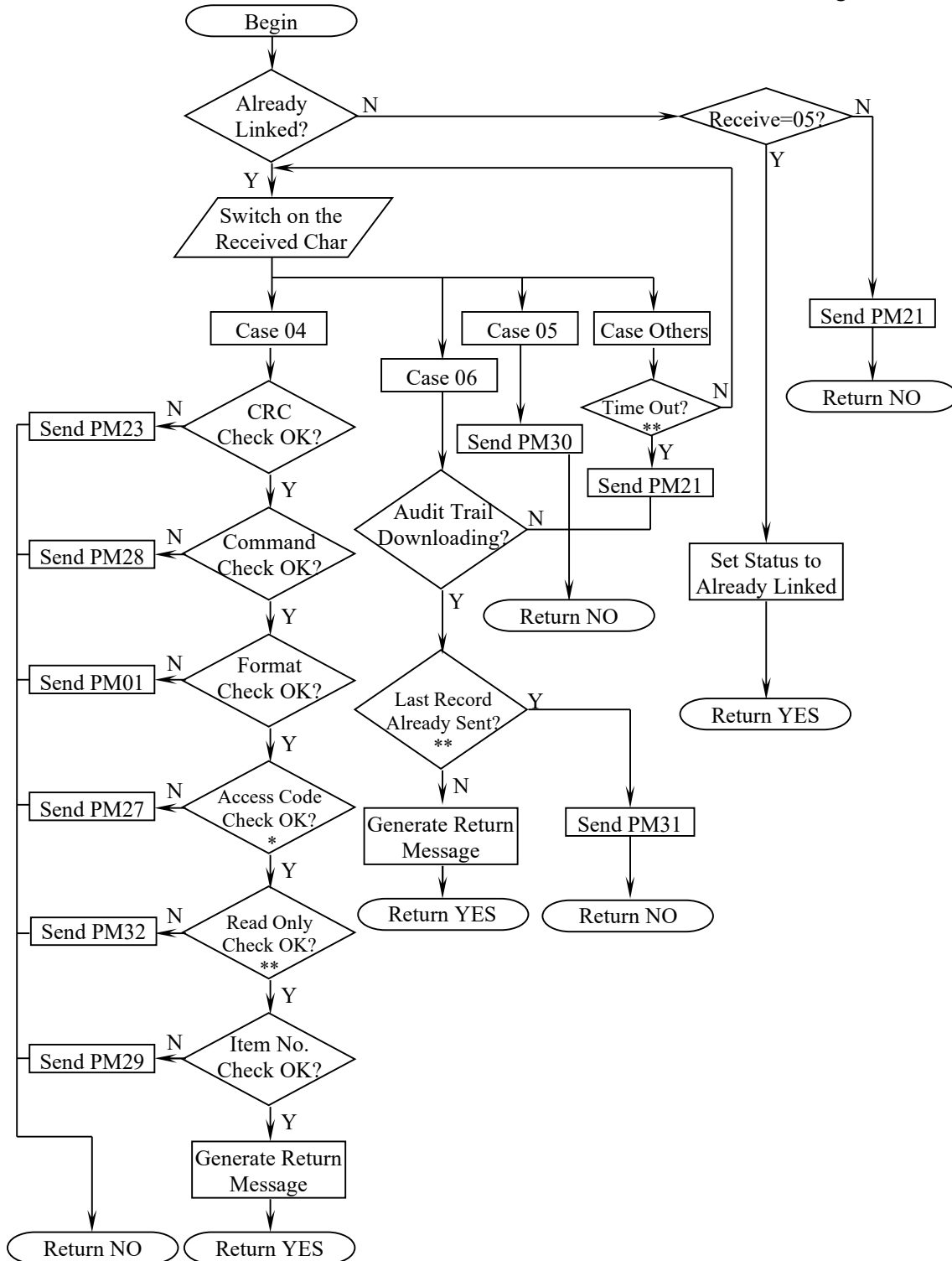


Figure 8-2. Receive OK Function Block of the ROMET Unit

Note:

- *: Only applicable communication function performs such kind of communication error check. For example, the Item Writing and the Access Code Changing Function (depict in the section 7, Communication Functions Flow Charts) perform the Access Code Check. On the contrary, the Item Reading and the Calibration Reading Function do not perform the Access Code Check.
- **: The current ROMET Unit does not support such kind of communication error check (according to the responding Error Message Window shown by the ROMETLink during the ROMET Unit Simulation program testing, the Unit should support such kind of check). If the Unit supports all kinds of communication error checks shown in the figure 8-2, it would be more robust during communication with the ROMETLink.

The Unit performs the following kinds of communication error checks.

- ❑ **Already Linked Check**
Because the ROMET Unit's behavior is different before linked and after linked, such kind of check must be performed.
- ❑ **Timeout Check**
When the Unit receives the first char of the communication command sent by the ROMETLink, it sets the timeout period and starts timeout counting. If the Unit cannot receive the special char (04, 05, 06 as shown in the figure 8-2) until the timeout period is expired, a Timeout Check is failure.
- ❑ **CRC Check**
As the ROMETLink, the ROMET Unit uses the CRC16-CCITT Algorithm to calculate the CRC Error Code and compares it with the received CRC Error Code.
- ❑ **Command Check**
Check whether the received command can be recognized.
- ❑ **Format Check**
Check whether the received command has the proper length.
- ❑ **Access Code Check**
Check whether the received Access Code is correct.
- ❑ **Read Only Check**
In the case of receiving one kind of changing command, such as the Item Writing Command and the Access Code Changing Command, check whether the Unit is set as a Read Only unit.
- ❑ **Item Number Check**
Check whether the received Item Number is legally defined. The Item Numbers 0~332 are defined by the ROMET Unit. So, reading the Item 332 is legal but reading the Item 333 is illegal. Please refer to the ROMET documents for more information about the Item Numbers and Item Codes definitions.

After pass all the above kinds of checks, the Unit generates the proper return message (including appending the calculated CRC code at the tail) based on the received command sent by the ROMETLink and returns YES from the Receive OK function block. Otherwise, the Unit sends the proper Pre-defined Message as a communication error indicator (as shown in the figure 8-2), then returns with NO.