

SECTION V

FIELD INFORMATION EXCHANGE

5.1 OVERVIEW

The PRCCI communicates with one or more GENISYS field code units over a half duplex code line. The PRCCI is the master on this circuit and initiates all conversations. Only the addressed field unit is permitted to respond. If the unit detects an error in decoding a transmission, the error is implied by the lack of a response. The PRCCI attempts a limited number of retries on messages when no response is seen or an error is detected in the response.

5.2 PHILOSOPHY AND SECURITY

The protocol uses modified binary characters to frame messages that are designed to lend themselves to hexadecimal interpretation. Characters in the range of \$F0 through \$FF are reserved as unique control characters. The character \$FF is illegal since it is commonly created on noisy data channels. Data security is provided in the form of a CRC-16 checksum. The generator polynomial is the standard CRC-16 polynomial:

$$X^{16} + X^{15} + X^2 + 1$$

Characters in the range of \$00 to \$EF are sent as is, in a single byte. A character in the range of \$F0 through \$FF is sent as a sequence of two bytes. This sequence consists of the data escape character \$F0 followed by the low order nibble (right hex digit) of the original character. The receiver of any message containing this sequence must always logically OR the two characters and treat the result as a single character.

Every message starts with a function specific header character (in the range of \$F1 through \$F3 or \$FA through \$FE) followed by a unit address. Any data, if applicable to the function, then follows. The data portion is function specific and may vary in length. Following the data is the CRC-16 then a \$F6 terminator character (End-of-Text or ETX). The CRC-16 is generated from the header, address, and data portion prior to any possible data escape sequences being introduced. Only the message header and terminator characters are excluded from any possible data escape sequence.

In general, messages are classified according to function with a unique header character for each class. Figure 5-1 summarizes the message headers used by the PRCCI in transmissions to GENISYS field code units. Figure 5-2 summarizes those used by GENISYS units to respond to PRCCI transmissions.

| HEADER | MESSAGE FUNCTION |
|--------|----------------------|
| F7 | |
| F8 | RESERVED |
| F9 | |
| FA | ACKNOWLEDGE AND POLL |
| FB | POLL |
| FC | CONTROL REQUEST |
| FD | INDICATION RECALL |
| FE | EXECUTE CONTROL |

Figure 5-1. PRCCI Generated Messages

| HEADER | MESSAGE FUNCTION |
|--------|-------------------|
| F1 | ACKNOWLEDGE |
| F2 | INDICATION |
| F3 | CONTROL CHECKBACK |

Figure 5-2. GENISYS Generated Messages.

5.3 PRCCI GENERATED MESSAGES

This section discusses the function and implementation of messages exchanged between a GENISYS PRCCI and a GENISYS field code unit. Each message must pass a variety of hardware and protocol level checks before it may be processed. The lower level hardware checks verify the line integrity, character framing, and that no data overrun has occurred (loss of data). The protocol level checks progressively verify any CRC-16, the message header, unit address, and any data portion of each message.

5.3.1 Poll

The poll message is generated to allow a GENISYS to return any new or changed indication information. This message has both a secure and non-secure format. The secure format contains a CRC-16 while the non-secure does not. The format used is determined by the secure poll flag in the E0 control byte. Either an indication or acknowledge is a valid response to this message.

5.3.2 Acknowledge And Poll

The acknowledge and poll message is generated to acknowledge an indication from a GENISYS and to poll for any additional information. All indication messages from a GENISYS must be acknowledged by the PRCCI. Until acknowledged, the unit assumes the PRCCI failed to receive the last response, and will re-transmit it in subsequent conversations. As with a poll message, either an indication or acknowledge is a valid response to this message.

5.3.3 Indication Recall

The indication recall message is generated to request all current indications from a GENISYS. The GENISYS is only permitted to respond with an indication message.

5.3.4 Control Request

The control request message is generated to request that a GENISYS deliver the specified control data. The PRCCI is only capable of transmitting a control message upon request from the office and does not attempt to filter changes in control data. It transmits all control data requested by the office, regardless of whether or not there is actually a change of state. Under normal circumstances, only the control data specified in a control request is transmitted. The exception to this is when the PRCCI detects that a station's control database is incomplete. When this occurs, the PRCCI waits for the next office control to that station and proceeds to transmit all valid control bytes regardless of whether or not all were requested. If control checkback is enabled the only legal response is a control checkback message. When checkback is disabled either an indication or acknowledge is a valid response to this message.

5.3.5 Execute Control

The execute control message is generated to request that a GENISYS execute a control request that had been previously verified with a checkback message from the unit. This message must immediately follow the control checkback or the PRCCI must repeat the sequence beginning with a retry of the control request. This message is illegal if control checkback is disabled. Either an indication or acknowledge is a valid response to this message.

5.4 GENISYS GENERATED MESSAGES

5.4.1 Control Checkback

The control checkback message is generated as part of the verification procedure for control delivery. It is only legal in response to a control request from the PRCCI when checkback is enabled. A proper checkback response returns the byte number and data for each control byte requested.

5.4.2 Indication

The indication message is generated to return indication data to the PRCCI. Indications are normally returned only when a change in state is detected or in response to a recall from the PRCCI. Excluding the E0 indication byte, an indication message may not contain an indication byte number that exceeds the maximum specified by the office at initialization.

5.4.3 Acknowledge

The acknowledge message is generated as a response when a GENISYS has no data to return to the PRCCI. This message has only a non-secure format that does not contain a CRC-16.

5.5 POLLING CYCLE DESCRIPTION

The PRCCI polls a pre-determined number of stations in a round robin fashion. To minimize delays in the polling cycle, due to errors or no response timeouts, failed stations are not polled. At the end of each polling cycle a recall is transmitted for a failed station in an attempt to eventually establish communication with all possible stations. Office requests for controls recalls take priority and may interrupt the normal polling cycle. When office requests are satisfied the polling resumes from the point at which it was interrupted.

Any time that either a hardware or protocol level error is detected for a live station the PRCCI skips to the next live station in the polling cycle. It then retries the transmission the next time that station is to be polled. A station error, or monitor condition, is reported to the office only after a complete retry set has been performed. A station failure is reported to the office only after a pre-determined number of retry sets have been exhausted.

5.6 E0 BYTE DESCRIPTION

The E0 byte provides for the control and indication of certain optional features including the use of secure polling and control checkback. Power-on or reset of a GENISYS unit is detected through the use of the database complete flag. That flag represents the current state of the unit's control database. The E0 byte flags are shown in figure 5-3.

The PRCCI automatically monitors the E0 indication byte and maintains the E0 control byte for each station. Except for the database complete flag, the flags to be set in the E0 control byte are determined by the office at initialization time. The office is not expected to specify an E0 control byte within a control request. The PRCCI assumes however, that any E0 indication byte returned from a GENISYS unit has changed and passes it to the office. This allows the office to also detect power-on or reset of a GENISYS unit.

The PRCCI determines if the transmission of an E0 control byte is required and relies on the next office control request for the station to determine when the transmission is permitted. An E0 control byte transmission is required if either the database complete flag is de-asserted or the state of any other flags in the byte do not match the office specified states.

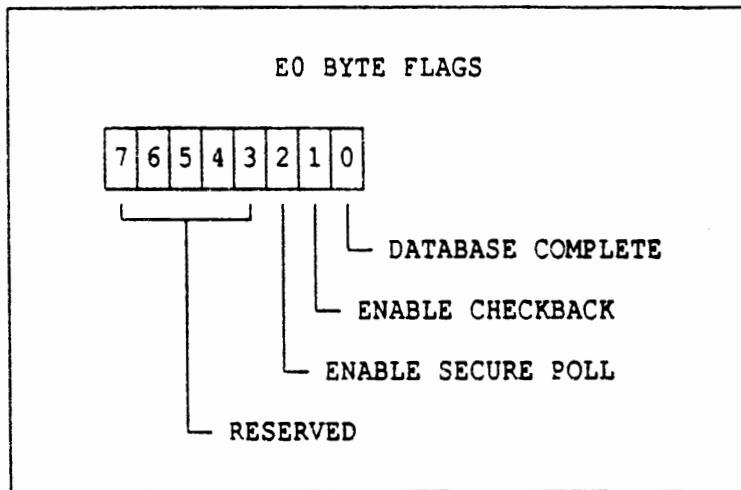


Figure 5-3. E0 Byte Flags