| ENGINEERING CHANGE ORDER | Number 03- | | |
|---|---|---|---|
| Project Engineer | Stephen L. Robinson | Cross Ref. Doc. Type & Number | Page 1 of |
| Change Requested By | Stephen L. Robinson | None | 1 |

**Description of Change**

Release of technical documentation for archive:

MPC System Inteface Protocol

**Reason for Change**    None

| Scope of Change | Documentation Affected | | |
|---|---|---|---|
| ☐ Changes Form, Fit, or Function | Product Model Number: None | | |
| ☐ Other performance enhancement | Drawing Number | Old Rev | New Rev |
| ☒ Internal | None | | |

| Type of Change | Material Disposition | | |
|---|---|---|---|
| ☐New Product | ☒None | | |
| ☐Error | ☐Scrap | | |
| ☐Design Improvement | ☐Rework | | |
| ☒Additional Info | ☐Finished Goods | | |
| ☐Cost Reduction | ☐Work In Progress | | |
| ☐Conform to Present Practices | ☐Stock | | |
| | ☐Running Change | | |

| Approvals | Engineering Signature | | Date | Manager's Initials in Appropriate Box | | |
|---|---|---|---|---|---|---|
| | Materials Signature | | Date | ☐ EWS    ☐ Hot    ☒ Normal | | |
| Cost Impact | 0 | New Comp. Cost | 0 | | | |
| Obsol. Impact | 0 | New Comp. Lead Time | 0 | | | |

| Required Tasks (use attachments if necessary) | Initials | Date |
|---|---|---|
| Manufacturing<br><br>None | | |
| Production<br><br>None | | |
| Materials<br><br>None | | |
| Stock Room<br>None | | |
| Sales / Marketing<br>None | | |
| Repair<br>None | | |
| Quality Assurance<br>None | | |
| Other<br>None | | |

# MPC SYSTEM
# RS-232 INTERFACE

## 1.1 GENERAL DESCRIPTION

The MPC Master Control Panel contains an 8031 microcomputer with on-board UART and RS-232 interface circuitry for communications with other MPC control panels, control receivers, and a Host Computer.

This section supplies the details necessary to understand RS-232 communications between the Host Computer and the MPC Master Control Panel as used in the Camera control system (figure 1).

## 1.2 MESSAGE FORMAT

Anytime a command message is sent from the Host Computer to the MPC Master Control Panel, the MPC Master will respond with an ACK or an NAK (figure 1). Data is transmitted using 1 start bit, 8 data bits, and 1 stop bit (no parity). The baud rate is set by a DIP switch located on the RS-232 board. It is typically set to 9600 baud.

The commands are sent using the command message format show in table 1. The various commands that may be transmitted are listed in table 2.

If the command message contains a latch function command, then the latch status response (table 3, Format of Latch Status Response) will be sent back to the Host Computer. If the command message contains a home function command, then the home status response (table 3, Format of Home Status Response from MPC) will be sent back to the Host Computer.

If the command is a position message, the response will be as shown in table 4.

If the command message contains only a momentary function, no further response beyond the ACK or NAK will occur. If the command message contains a communications error (e.g., an address to an non-existent control receiver or a failure in the communications system), then the command error message response (in table 3, with B3 of byte 3 equal to 1) will be sent back.

Table 5 gives the RS-232 switch message format.

Table 6 gives the ID message format for communications from a host computer to the master control panel. An ACK or NAK is returned.

## 1.3 MAINTENANCE

No maintenance adjustments are required for the RS-232 circuits on the processor board.

## 1.4 PARTS LIST

Refer to the processor board for parts identifications.

## 1.5 SCHEMATIC DIAGRAMS

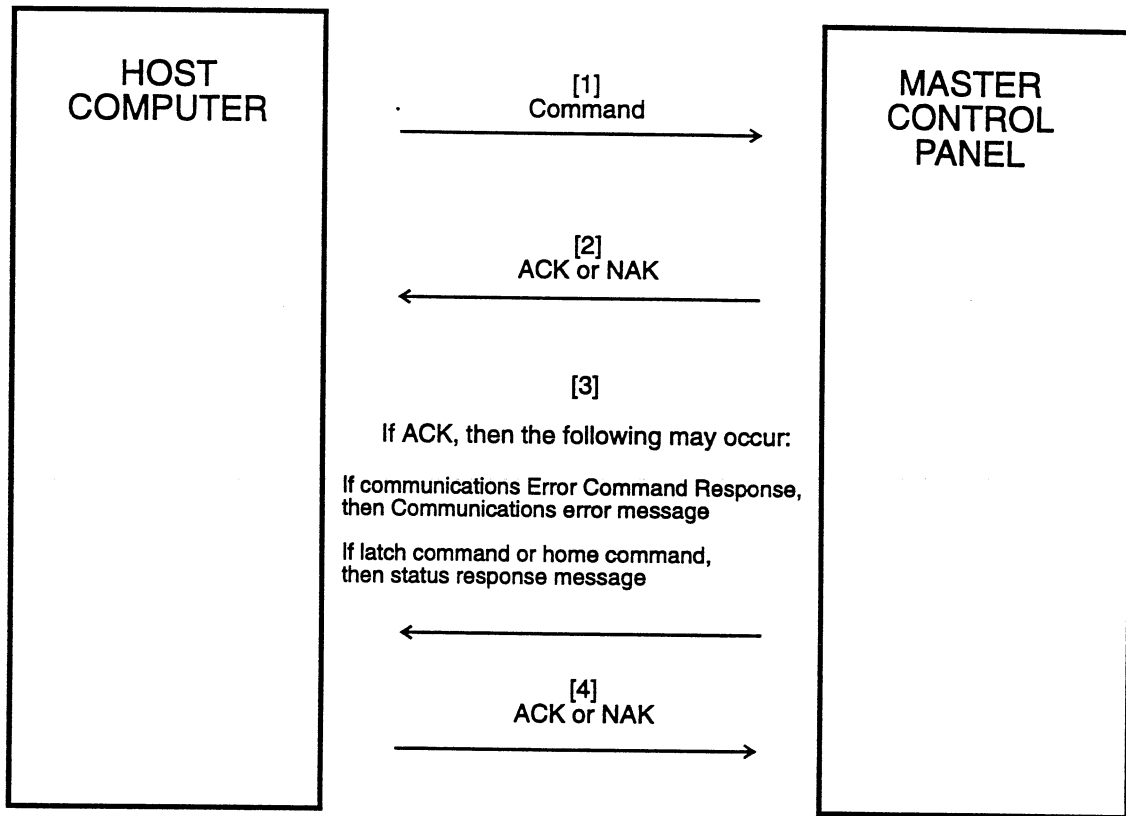Refer to the processor board for the schematic diagram.

## FIGURE 1. TYPICAL COMMUNICATIONS PROTOCOL

HOST COMPUTER

MASTER CONTROL PANEL

[1] Command →

[2] ACK or NAK ←

[3]

If ACK, then the following may occur:

If communications Error Command Response, then Communications error message

If latch command or home command, then status response message

←

[4] ACK or NAK →

## TABLE 1. RS-232 COMMAND MESSAGE FORMAT

| BYTE | DATA | DESCRIPTION |
|------|------|-------------|
| 0 | STX | Start of message ($02_H$) |
| 1 | Address in hex | Camera address ($01_H$—$DF_H$) |
| 2 TO 2N+1 | Command Data | See table 2 |
| 2N+2 | CHECKSUM | $80_H$—$8F_H$ Least significant nibble is EXCLUSIVE-OR of all previous bytes (LS NIBBLE only) except STX |
| 2N+3 | ETX | End of Message ($03_H$) |
| NOTE: N is the number of commands in the message | | |

## TABLE 2. RS-232 COMMAND DATA

| BYTE | DATA | DESCRIPTION |
|---|---|---|
| **MOMENTARY** | | |
| RESET CONTROL RECEIVER | "rs" | DATA consists of the ASCII codes for the two letters shown: |
| PAN LEFT | "PL" | rs=ASCII codes for r and s |
| PAN RIGHT | "PR" | PL=ASCII codes for P and L, etc. |
| PAN STOP | "PS" | |
| TILT UP | "TU" | |
| TILT DOWN | "TD" | |
| TILT STOP | "TS" | |
| ZOOM IN | "ZI" | |
| ZOOM OUT | "ZO" | |
| ZOOM STOP | "ZS" | |
| FOCUS NEAR | "FN" | |
| FOCUS FAR | "FF" | |
| FOCUS STOP | "FS" | |
| IRIS OPEN | "IO" | |
| IRIS CLOSE | "IC" | |
| IRIS STOP | "IS" | |
| P/T POSITION REQUEST | "P?" | |
| P/T GOTO COMMAND | "pA2A1A0E2E1E0" | See table 4 for position format |
| LENS POSITION REQUEST | "V?" | |
| LENS GOTO COMMAND | "vA2A1A0E2E1E0" | |
| **LATCH** | | |
| MANUAL IRIS TOGGLE | "LM" | |
| CAMERA POWER TOGGLE | "LP" | See table 3 for response format |
| LENS SPEED TOGGLE | "LL" | |
| LATCH STATUS REQUEST | "L?" | |
| AUX FUNCTIONS (Option 1) | "L1"—"L3" | Toggles Aux 1, Aux 2, or Aux 3 |
| COLOR BALANCE (Option 2) | "L1" | Select auto/manual mode |
| | "B1" | Increase blue |
| | "B2" | Increase red |
| | "B0" | Balance stop |
| **HOME** | | |
| HOME POSITION GOTO Preset 1—9 | "H0"—"H9" | A home active "HA" will be immediate response. Later a home position "H0" to "H9" or home error "HE" will be generated |
| HOME POSITION STORE Program 0—9 | "P0"—"P9" | |
| HOME POSITION STATUS REQUEST | "H?" | Will generate a home status response See table 3 |

# TABLE 3. RS-232 RESPONSE MESSAGE

| BYTE | DATA | DESCRIPTION |
|---|---|---|
| FORMAT OF LATCH STATUS RESPONSE FROM MPC | | |
| 0 | STX | Start of message (02$_H$) |
| 1 | Address in hex | Camera address 01$_H$—DF$_H$ |
| 2 | "L" | Latch Status |
| 3 | 30$_H$—37$_H$ or 38$_H$ (Comm error) | LS NIBBLE is four bits of status<br><br>**Bit Value 0/1**<br>B0=Iris Auto Manual<br>B1=Camera power Off/On<br>B2=Lens Speed Slow/Fast<br>B3=Communications Error No/Yes |
| 4 | "A" | Aux Status |
| 5 | 30$_H$—37$_H$ | LS NIBBLE is four bits of status<br>Bit Value 0/1<br>B0=Aux 1<br>B1=Aux 2<br>B2=Aux 3 |
| 6 | CHECKSUM | 80$_H$—8F$_H$ Least significant nibble is EXCLUSIVE-OR of all previous bytes (LS NIBBLE only) except STX |
| 7 | ETX | End of message (03$_H$) |
| FORMAT OF HOME STATUS RESPONSE FROM MPC | | |
| 0 | STX | Start of message (02$_H$) |
| 1 | Address in hex | Camera address 01$_H$—DF$_H$ |
| 2 | "H" | Home Status |
| 3 | "0"—"9" or "A", or "I", or "E" | ie, 2=Home position 2<br>A=Home active<br>I=Not-at-Home position, or active<br>E=Home error—could not get to home position |
| 4 | Checksum | 80$_H$—8F$_H$ Least significant nibble is EXCLUSIVE-OR of all previous bytes (LS NIBBLE only) except STX |
| 5 | ETX | End of message (03$_H$) |

**CHANGE 1**

## TABLE 4. MPC POSITION MESSAGE

| BYTE | DATA | DESCRIPTION |
|------|------|-------------|
| | **FORMAT OF PAN/TILT POSITION MESSAGE** | |
| 0 | STX | Start of message ($02_H$) |
| 1 | Address in hex | Camera address ($01_H$ to $DF_H$) |
| 2 | "P" or "p" | Upper case "P" is response; Lower case "p" is GOTO command |
| 3 | A2 (MS nibble) | Azimuth position (See Notes) |
| 4 | A1 | |
| 5 | A0 (LS nibble) | |
| 6 | E2 (MS nibble) | Elevation position (See Notes ) |
| 7 | E1 | |
| 8 | E0 (LS nibble) | |
| 9 | CHECKSUM | $80_H$—$8F_H$ Least significant nibble is EXCLUSIVE-OR of all previous bytes (LS NIBBLE only) except STX |
| 10 | ETX | End of message ($03_H$) |
| | **FORMAT OF ZOOM/FOCUS POSITION MESSAGE** | |
| 0 | STX | Start of message ($02_H$) |
| 1 | Address in hex | Camera address ($01_H$ to $DF_H$) |
| 2 | "V" or "v" | Upper case "V" is response; Lower case "v" is GOTO command |
| 3 | A2 (MS nibble) | Zoom position (See Notes) |
| 4 | A1 | |
| 5 | A0 (LS nibble) | |
| 6 | E2 (MS nibble) | Focus position (See Notes ) |
| 7 | E1 | |
| 8 | E0 (LS nibble) | |
| 9 | CHECKSUM | $80_H$—$8F_H$ Least significant nibble is EXCLUSIVE-OR of all previous bytes (LS NIBBLE only) except STX |
| 10 | ETX | End of message ($03_H$) |

NOTES:

The 12-bit position data is contained in nibbles 0—2, with nibble 0=$b_0$—$b_3$, nibble 1=$b_4$—$b_7$, and nibble 2=$b_8$—$b_{11}$. The nibble is then added to $30_H$ to produce a value from $30_H$ to $3F_H$

Example: Azimuth data $b_0$—$b_3$ is expressed as $A_0$ (azimuth nibble 0)

## Table 5. RS-232 SWITCH MESSAGE FORMAT

| BYTE | DATA | DESCRIPTION |
|---|---|---|
| 0 | STX | Start of message (02$_H$) |
| 1 | Address in hex | The remote control panel address in hex that the switch message will be displayed on. This remote will also be given control of the control receiver for the camera number in the switch message (if applicable). Binary 0 to 30 valid for remote control panels. Binary 31 refers to the master control panel. Data greater than 31 will provide for video switching only; no control panel is associated. |
| 2 | "S" | ASCII character for letter S |
| 3 | C100 | ASCII character for the camera number. C100 is the hundred's digit, C10 is the ten's digit, and C1 is the unit's digit |
| 4 | C10 | |
| 5 | C1 | |
| 6 | M100 | ASCII character for monitor number. M100 is the hundres's digit, M10 is the ten's digit, and M1 is the unit's digit |
| 7 | M10 | |
| 8 | M1 | |
| 9 | CHKSUM | CHKSUM is a hexadecimal number 80$_H$ to 8F$_H$. The least significant (nibble) is the EXCLUSIVE-OR of all previous bytes (LS NIBBLE only) except STX |
| 10 | ETX | End of Message (03$_H$) |

# TABLE 6. ID MESSAGE FORMAT

| BYTE | DATA | DESCRIPTION |
|---|---|---|
| FORMAT OF SELECT MODE MESSAGE | | |
| 0 | STX | Start of Message (02$_H$) |
| 1 | Address in hex | Camera address (01$_H$ to DF$_H$) |
| 2 | 'd' | Display message |
| 3 | 'M' | Mode select |
| 4 | 'M'<br>'I' | Menu mode<br>ID mode |
| 5 | CHECKSUM | 80$_H$—8F$_H$ Least significant nibble is EXCLUSIVE-OR of all previous bytes (LS NIBBLE only) except STX |
| 6 | ETX | End of Message (03$_H$) |
| FORMAT OF ID ENABLE/DISABLE MESSAGE | | |
| 0 | STX | Start of Message (02$_H$) |
| 1 | Address in hex | Camera address (01$_H$ to DF$_H$) |
| 2 | 'd' | Display message |
| 3 | 'I' | ID display |
| 4 | 'D'<br>'E' | Disable ID display<br>Enable ID display |
| 5 | CHECKSUM | 80$_H$—8F$_H$ Least significant nibble is EXCLUSIVE-OR of all previous bytes (LS NIBBLE only) except STX |
| 6 | ETX | End of Message (03$_H$) |
| FORMAT OF ID CLEAR SCREEN MESSAGE | | |
| 0 | STX | Start of Message (02$_H$) |
| 1 | Address in hex | Camera address (01$_H$ to DF$_H$) |
| 2 | 'd' | Display message |
| 3 | 'C' | Clear screen |
| 4 | CHECKSUM | 80$_H$—8F$_H$ Least significant nibble is EXCLUSIVE-OR of all previous bytes (LS NIBBLE only) except STX |
| 5 | ETX | End of Message (03$_H$) |
| *Continued* | | |

# TABLE 6. ID MESSAGE FORMAT (Continued)

| | FORMAT OF SELECT ID TOP MESSAGE | | |
|---|---|---|---|
| 0 | STX | Start of message (02$_H$) |
| 1 | Address in hex | Camera address (01$_H$ to DF$_H$) |
| 2 | 'd' | Display message |
| 3 | 'I' | ID display |
| 4 | 'T' | ID at top |
| 5 | CHECKSUM | 80$_H$—8F$_H$ Least significant nibble is EXCLUSIVE-OR of all previous bytes (LS NIBBLE only) except STX |
| 6 | ETX | End of Message (03$_H$) |
| | FORMAT OF SELECT ID BOTTOM MESSAGE | | |
| 0 | STX | Start of message (02$_H$) |
| 1 | Address in hex | Camera address (01$_H$ to DF$_H$) |
| 2 | 'd' | Display message |
| 3 | 'I' | ID display |
| 4 | 'B' | ID at bottom |
| 5 | CHECKSUM | 80$_H$—8F$_H$ Least significant nibble is EXCLUSIVE-OR of all previous bytes (LS NIBBLE only) except STX |
| 6 | ETX | End of Message (03$_H$) |
| | FORMAT OF UPDATE LINE MESSAGE | | |
| 0 | STX | Start of message (02$_H$) |
| 1 | Address in hex | Camera address (01$_H$ to DF$_H$) |
| 2 | 'd' | Display message |
| 3 | 'L' | Line of text |
| 4 | '1'-'<' (31$_H$ - 3C$_H$) | Line number (1-12) + 30$_H$ |
| 5 | (ID text) | ASCII characters (up to 24) for the line starting with the leftmost character |
| N | CHECKSUM | 80$_H$—8F$_H$ Least significant nibble is EXCLUSIVE-OR of all previous bytes (LS NIBBLE only) except STX |
| N+1 | ETX | End of Message (03$_H$) |
| | Continued | | |

# TABLE 6. ID MESSAGE FORMAT (Continued)

| | | FORMAT OF ALARM DISPLAY MESSAGE |
|---|---|---|
| 0 | STX | Start of message (02$_H$) |
| 1 | Address in hex | Camera address (01$_H$ to DF$_H$) |
| 2 | 'd' | Display message |
| 3 | 'A' | Alarm message |
| 4 | '1'-'3' (31$_H$ - 33$_H$) 'B' | Display line number (1-3) + 30$_H$ Blink alarm message |
| 5 | 'E' 'D' | Enable alarm message Disable alarm message |
| 6 | CHECKSUM | 80$_H$—8F$_H$ Least significant nibble is EXCLUSIVE-OR of all previous bytes (LS NIBBLE only) except STX |
| 7 | ETX | End of Message (03$_H$) |
| NOTE: For all messages from a host computer to the master control panel , ACK or NAK is returned. | | |

**COHU**

Cohu, Inc./Electronics Division

6X-5030
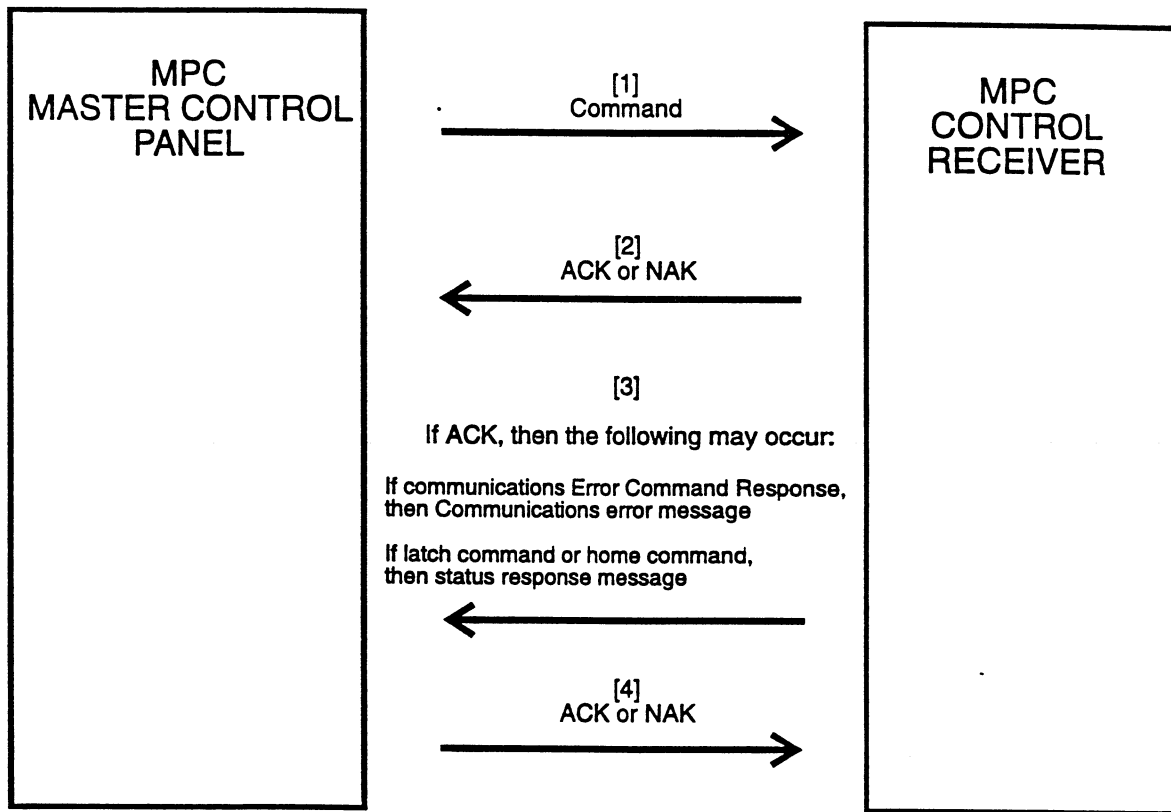
FIGURE 1. TYPICAL COMMUNICATIONS PROTOCOL

## TABLE 1. RS-422 COMMAND MESSAGE FORMAT

| BYTE | DATA | DESCRIPTION |
|------|------|-------------|
| 0 | F8$_H$ | Autobaud character |
| 1 | Address in hex | Camera address (01$_H$—DF$_H$) |
| 2 TO 2N+1 | Command Data | See table 2 |
| 2N+2 | CHECKSUM | 80$_H$—8F$_H$ Least significant nibble is EXCLUSIVE-OR of all previous bytes (LS NIBBLE only) except F8 |
| NOTE: N is the number of commands in the message | | |