

SYSTEM OVERVIEW

The Telesis® BenchMark® 460 marking system permanently marks messages into materials such as steel, aluminum, and plastic. An electric solenoid accelerates a hardened pin to indent dot matrix characters into the item being marked. Character shape, size, density, and location are determined by the user through the marking system software.

Marking Head. The BenchMark460 marking head is an electromechanical marker. The internal mechanical components position the pin cartridge, and an electric solenoid fires the marking pin. A spring returns the pin to its idle position within the cartridge. The marking head moves the pin cartridge through X- and Y-axis rectilinear motions to reach the correct position for each dot of the characters to be marked. The system software controls pin extension to mark the message.

The marker's two stepper-motor drives rapidly and accurately position the pin at coordinate-defined locations in the marking window within 0.006 mm (0.00024 inch). The marker accommodates the rigorous dynamics of impacting, rebounding, and rapid positioning of the marking pin through a linear rail/ball bearing saddle assembly, ceramic-coated guide shaft/linear bushing assemblies, and drive motors with concentric, linear drive screws.

The lightweight and portable BenchMark460 was designed for remote operation. The handheld marker incorporates a pistol grip handle with a Start Print push button switch. It can be used in virtually any orientation. The integral standoff with its padded front surface is held against the marking surface while marking. The standoff can be adjusted forward and aft to change the pin stroke.

Marker Cable. The marker cable connects the marker to the BM470 controller. The cable is 4 m (13 feet) and is prewired to the marking head.

Pin Cartridge. The pin cartridge is machined from engineered plastic materials and offers long life with little maintenance. Screws attach the pin cartridge to the marking head for easy removal, cleaning, and pin replacement.

Marking Pins. The 25XLE-series marking pins are made of tungsten carbide and are available in 30° and 45° cone angles.

Controller. The BM470 controller provides a text-only operator interface and allows full operational control of the marking head. It contains an integrated keyboard with an LCD display. The back panel provides an electrical interface for connecting optional remote I/O sources. Refer to BM470 Controller Specifications for details.

SYSTEM OPTIONS

- BM470 Controller Wall-Mounting Bracket Kit
- Barcode Scanner or Barcode Wand with Cable
- Foot Switch (Start Print) or Push Button Station (Start/Abort)
- Backup Utility Software
- Upgrade Utility Software
- Logo/Font Generator Software
- BM470+ Enhanced Communications Software

SYSTEM SETUP



CAUTION

The BM470 controller is not a sealed unit. Protect it from potentially damaging conditions and contaminants. Do not block the vents in the bottom of the case. Ensure the marking system is electrically isolated from any devices that may generate extreme electromagnetic interference (EMI).

1. Locate the controller as close as practical to the marking head. Standard marker cable length is 4 m (13 feet).
2. Ensure the controller power switch on the back panel is OFF. Connect the power cable to the controller.
3. Connect the marker cable from the marking head to the controller, and securely tighten the cable.
4. To start the marking system software, position the controller power switch on the back panel to ON.
5. Adjust the standoff position as necessary to increase or decrease the pin stroke for proper pin impact depth.

BENCHMARK460 MARKING HEAD

Specifications

The BenchMark460 marking head specifications are subject to change without notice.

Dimensions.....	see the BenchMark460 Marking Head Dimensions drawing for details
Weight	
Marking Head	1.58 kg (3.47 lb)
Marker Cable	0.80 kg (1.76 lb)
Noise	80.4 dB (maximum) 72.5 dB (LEQ) see Marking Noise
Vibration	Does not exceed 2.5 m/s ² see Vibration Data for details
Operating Temperature. .	0° to 50°C (32° to 122°F), non-condensing
Marking Area	100 x 25 mm (4.0 x 1.0 inches)
Pin Types.....	25XLE-series
Pin Material.....	Tungsten Carbide

Marking Characteristics

The BenchMark460 can accommodate character sizes from .762 to 25 mm (.030 to 1.0 inch) in .025 mm (.001-inch) increments. Characters can be rotated in 1° increments with marking resolutions from 4 dots/cm (10 dots/inch) to 32 dots/cm (80 dots/inch) for an engraved look.

Marking Speeds

The system generally marks a maximum of 2.3 characters per second using 5 x 7 font, 3 mm (.118-inch) high, 2mm (.080-inch) wide characters. Speeds vary slightly depending on the selected character size, style, and dot density. Specific times can be verified by a Telesis representative.

Marking Noise

Although every attempt is made to reduce noise, the material being marked significantly influences the noise level. For example, marking a solid lead block produces less noise than marking a thin-walled steel pipe. noise level.

Marking Depth

The BenchMark460 can obtain a marking depth of .127 mm (.005 inch) in mild steel (Rb53) using a 25XLE carbide pin with a 45° cone angle. The depth of mark can be adjusted over a significant range by changing the impact force (software parameter) or the impact distance (pin stroke). Note the maximum pin stroke distance is 4 mm (.15 inch). Specific depths can be verified by a Telesis representative.

Pin Life

Pin life depends largely on the type of material being marked, its hardness or abrasiveness, and the required marking depth. On typical metals with a hardness of Rockwell Rb47, marking at a depth of .127 mm (.005 inch), carbide pins average approximately 9 million impressions before needing sharpened.

Vibration Data

Total hand-arm vibration does not exceed 2.5 m/s². Vibration tests were performed under controlled conditions imitating, as closely as possible, typical normal operation.

Conditions such as rigidity of the work piece, material, and machine settings vary in actual operational use and could alter the actual vibration level. Despite detailed guidance instructions provided with each machine, such conditions are beyond the control of Telesis and must remain the responsibility of end users. Users should conduct their own tests to establish safe working levels of use.

The vibration tests were conducted using the following parameters:

Pin Stroke	8 mm (.31 inch)
Marking Base.....	20 mm (.79 inch) thick steel
Marking Surfaces.....	2 mm (.08 inch) thick steel plate 4 mm (.16 inch) thick aluminum plate
Marking Mode	Dot
Text Marked	TELESIS (11 x 16 font, 5 mm [.20 inch] characters) HHHEEE000888 (5 x 7 font, 3 mm [.12 inch] characters)

The worst-case scenarios under the given test conditions are listed in the following table.

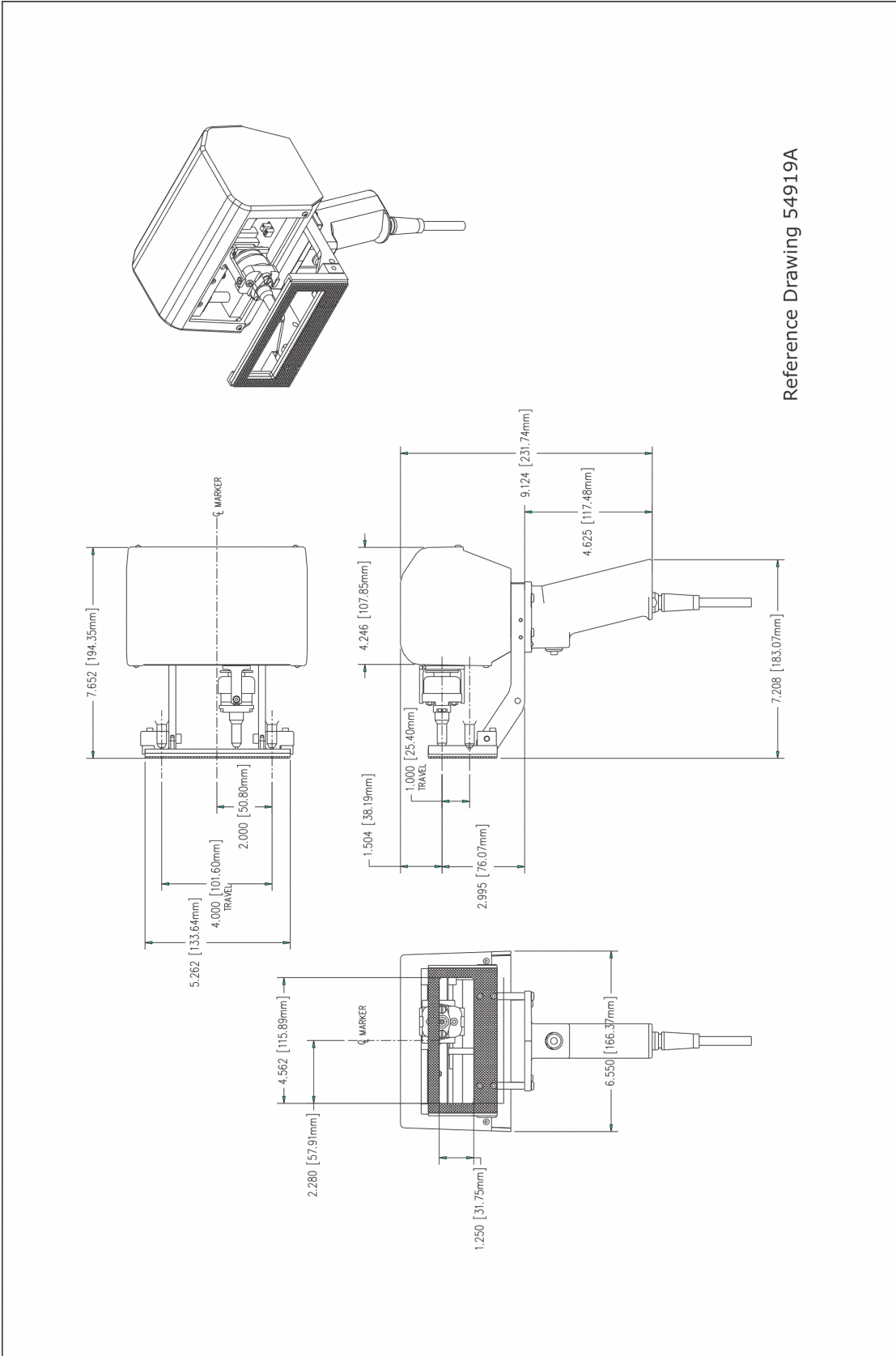
Steel Marking Surface			Aluminum Marking Surface		
VM	T _(EAV)	T _(ELV)	VM	T _(EAV)	T _(ELV)
2.1 m/s ²	11 hr 51 min	more than 24 hr	1.8 m/s ²	15 hr 58 min	more than 24 hr

where:

VM = hand/arm vibration magnitude.

T_(EAV) = time to reach the Exposure Action Value based on continuous marking.

T_(ELV) = time to reach the Exposure Limit Value based on continuous marking.



Reference Drawing 54919A

BenchMark460 Marking Head Dimension

BM470 CONTROLLER

Specifications

The BM470 controller specifications are subject to change without notice.

Compliance.....	CE, RoHS
Rating	NEMA 1 (I. P. 30)
Mounting Configuration ..	Tabletop
Dimensions.....	see the BM470 Controller Dimensions drawing for details
Weight (controller only) ..	1.68 kg (3.69 lb)
Power Requirements	95 to 250 VAC 2 amps 50-60 Hz, single phase
Operating Temperature ..	0° to 50°C (32° to 122°F), non-condensing
Operating Humidity.....	10% to 80% non-condensing
Cooling.....	Internal, thermostatically controlled fan
Communications.....	TTL, RS232, and USB*
Input Signals**	Two available (Start Print, Stop/Abort) 10 VDC (minimum voltage) 30 VDC (maximum voltage) 12 to 24 VDC (nominal voltage) 2.3 mA @ 12 VDC; 4.9 mA @ 24 VDC (nominal current)

* USB for data backup and transfer

** Additional I/O signals available with the optional
BM470+ Enhanced Communications Software

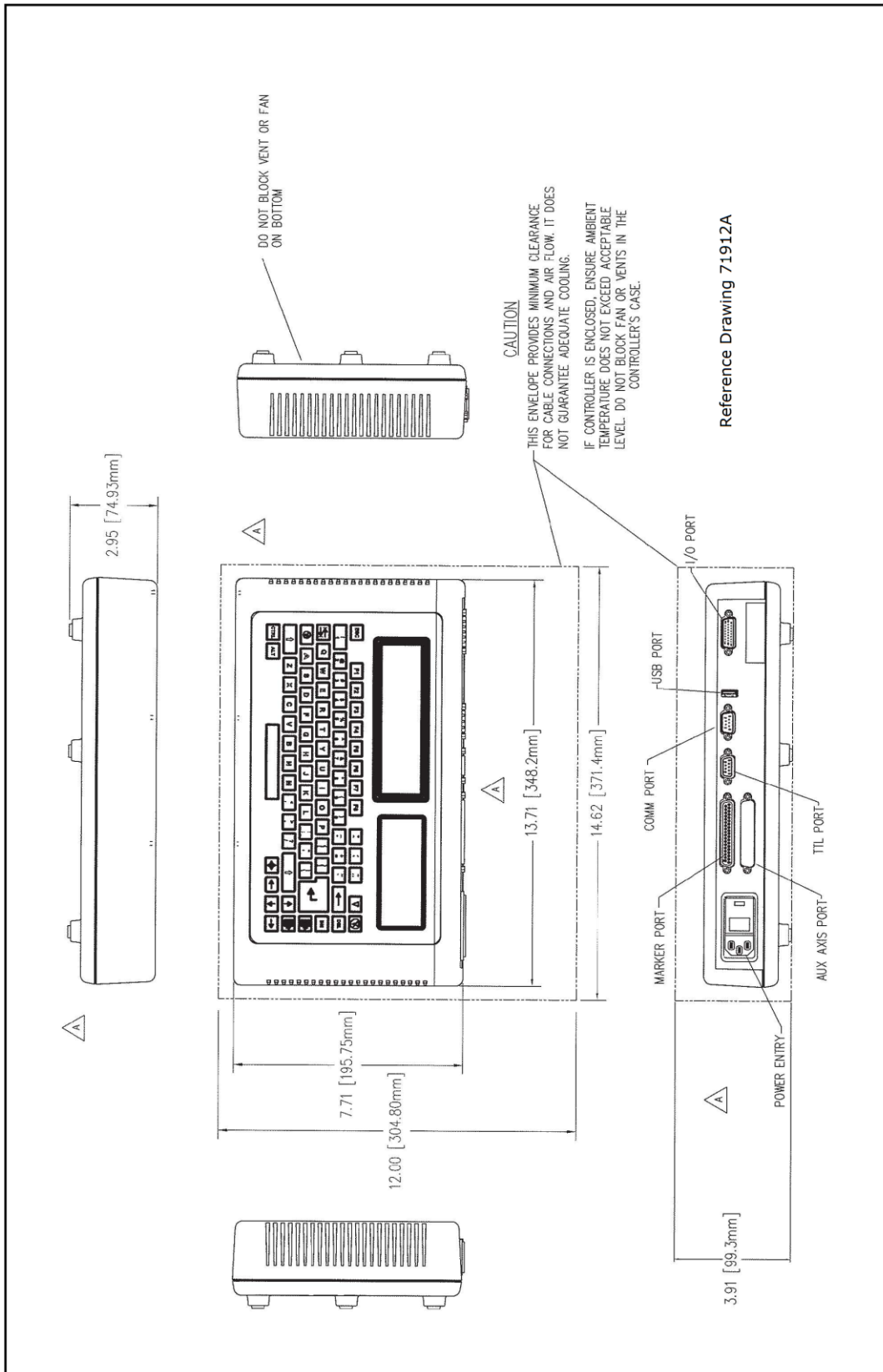
Environmental Considerations

The following environmental considerations must be taken into account when installing the BM470 controller.

Contaminants. The vented and fan-cooled controller is rated NEMA 1 (I. P. 30). In environments where solid or liquid contaminants are present, the contaminants can be drawn into the controller and cause the electronic components to fail. For that reason, in these types of environments, the controller must be located in a sealed industrial enclosure.

EMI Susceptibility. Although the system has been found to be in compliance with pertinent susceptibility standards, care should be taken when installing near welders and other extreme generators of electromagnetic interference (EMI).

Particular care should be taken to ensure welder currents are not injected through the marking head chassis. The marking head chassis is connected to the electrical service earth ground through the marking head cable. The marking head should be electrically isolated from all surfaces which could become part of a welder current path.



BM470 Controller Dimensions

Interface Panel

The back panel of the BM470 controller provides ports for connecting the marker and optional accessories.

Marker Port. The Marker port connects the BenchMark460 marking head to the BM470 controller. It supplies the marking head with electrical power and provides input and output signals to and from the controller for marker operation.

TTL Port. The TTL port is configured only for VDC input. It allows the system to connect with a simple contact closure circuit, such as a remote push button station or foot pedal switch. These types of devices can remotely control Start Print and Stop (Abort) Print operations.

Comm Port. The Comm port allows connection to a remote serial device. The Comm port can be used to connect an optional customer-supplied PC to access Telesis software utilities. Utility software can be used to back up patterns stored in the controller, download a custom font to the controller, or download controller software upgrades. The Comm port also allows you to connect an optional barcode scanner. The software reads the scanned input and inserts the data into a variable text field within the currently loaded pattern.

USB Port. The USB port allows you to connect a memory stick or flash drive for pattern storage or retrieval and for software upgrades.

Auxiliary Axis Port (optional). The Auxiliary Axis port is available only if the controller is configured with the optional auxiliary-axis circuit card. This configuration allows connection to a rotational drive unit to use the software Theta-axis features.

System Software

The system software provides the user interface for the operator to control the marker and is permanently installed in the controller. The software also provides a library for storing, loading, and editing user-defined patterns.

Patterns are files stored in the controller's memory. Depending on the size of the pattern files, the controller can store up to 200 patterns. Each pattern contains one or more fields; each field defines a single object.

Printable objects can be created to define text strings, arc-text strings, geometric shapes, graphics, and machine-readable data matrix symbols. Printable text fields can include alphanumeric characters, symbols, and special message flags. Message flags insert data, such as serial numbers, times, dates, and user-defined codes, into the text string.

Non-printable objects can be defined to specify commands for the marker to execute (for example, Go To, Print, and Stop).

BM470+ ENHANCED COMMUNICATIONS SOFTWARE

The optional BM470+ Enhanced Communications software allows you to expand the controller's communication capability. It makes full use of the I/O port and allows you to configure the Comm port communication parameters. See I/O Control Signals and Host Communications (below) for more information.

I/O Control Signals

Additional input and output signals are available through the I/O port only if the system uses the optional BM470+ Enhanced Communications software.

The I/O port is configured for 12 to 24 VDC I/O only and can be used to connect a PLC or other DC I/O source. The optically isolated I/O port allows you to remotely select and load patterns, start marking, stop marking, place the marker online, and monitor system output signals.

Cable connectors and connector pins are supplied with the controller for constructing appropriate interface cables.

Input Signals. Input signals provide the following controls:

INPUT COMM	For all inputs (+ or – supply)
START PRINT	Begins the marking cycle
STOP	Stops the marking cycle
SEL_0 thru _6 *	Remotely selects & loads up to 127* pattern files
SPARE_1, 2, 3.....	Three (3) spares for custom applications

* The system software allows the SEL_6 signal to be configured to remotely select patterns or to remotely place the marker online. If used to place the marker online, pattern selection is reduced to a maximum of 63 patterns.

Output Signals. Output signals indicate the following states:

OUTPUT COMM.....	For all outputs (+ or – supply)
DONE	Marking cycle is complete
READY	System is ready for a message or for a Start Print command
PAUSED	System is paused (waiting timeout or command)
NO FAULT	System status (normal or fault detected)
SPARE_1, 2	Two (2) spares for custom applications

Host Communications

The BM470+ Enhanced Communications software allows you to configure the RS-232 parameters for the Comm port.

The serial interface is most often used to connect a host computer, a data terminal, or a barcode scanner. The serial data character format for all transmissions to and from the BM470 controller is:

- Asynchronous
- 1200, 2400, 4800, 9600, 19200, 38400, or 115200 Baud
- 1 or 2 Stop Bits
- 7 or 8 Data Bits
- None, Even, or Odd Parity

In addition to defining Comm port communication parameters, you can select Extended Protocol or Programmable Protocol.

Programmable Protocol. Use this protocol where very simple one-way communications are required, such as with barcode scanners. Programmable Protocol provides no error checking or acknowledgment of the transmitted data. Note XON/XOFF Protocol applies even when Programmable Protocol is selected.

Starting Character specifies where the software begins to count character positions. This number must be entered in decimal format (for example, "2" for the ASCII Start of Text "STX").

Terminating Character identifies the end of transmitted string (usually "13" for the ASCII carriage return character).

Character Position counts from the starting character and ignores all characters preceding it.

Character Length accepts variable-length messages (if set to 0) or messages of a pre-specified, fixed number of characters.

Ignore Character identifies the character to ignore when sent from the host (usually "10" for the ASCII line feed character).

Message Type allows message-type recognition, which defines how the marking system uses data it receives from the host.

- 1 Message type 1 overwrites the first line of the first text field with data extracted from the host
- P Message type P loads a specific pattern identified by data extracted from the host
- Q Message type Q updates the text in the first query buffer with data extracted from the host
- V Message type V updates the first variable text flag found in the pattern with data extracted from the host
- 0 Message type 0 (zero) indicates the host will provide the message type, field number (if applicable), line number (if applicable), and data; delegates message type selection to the host on a message-by-message basis. The host message must use the format:

Tnn <string>

where:

T = 1, P, Q, or V indicates the message type

nn = two-digit field number or query text buffer indicates where data will be placed.
Note: Not used with Message Type P.

<string>= For Message Type P, indicates the pattern name to be loaded.

For Message Types 1, Q, or V, indicates the data to be inserted into the field or the query text buffer.

Extended Protocol. This protocol selection includes error checking and transmission acknowledgment. It should be used in applications where serial communication is a vital part of the marking operation. All communications are carried out in a parent/child relationship with the host being the parent. Only the host can initiate communications. If the host does not receive a response within three seconds, it should retransmit its original message. If no response is received after three tries, it should declare the link to be down.

The Extended Protocol message format as sent from the host to the BM470 controller is described below.

SOH TYPE [##] STX [DATA] ETX BCC CR

where:

SOH ASCII Start of Header character (001H). The controller ignores all characters received prior to the SOH.

TYPE A single, printable ASCII character that defines the meaning (type) and content of the message downloaded from the host, where:

1 Message Type 1 overwrites a specific field in currently loaded pattern with data supplied in the host message. See [DATA] for details.

G Message Type G initiates a print cycle to mark the currently loaded pattern.

I Message Type I requests the marker return the status of standard output and input signals. The system returns a hexadecimal code for the 6 output signals and 12 input signals in the following format:

O O ; I I I

where:

bit 1 READY 0x01

bit 2 DONE 0x02

bit 3 PAUSED 0x04

bit 4 NO_FAULT 0x08

bit 5 SPARE_1 0x10

bit 6 SPARE_2 0x20

bit 1 START 0x001

bit 2 STOP 0x002

bit 3 SEL_0 0x004

bit 4 SEL_1 0x008

bit 5 SEL_2 0x010

bit 6 SEL_3 0x020

bit 7 SEL_6* 0x040

bit 8 SEL_4 0x080

bit 9 SEL_5 0x100

bit 10 SPARE_1 0x200

bit 11 SPARE_2 0x400

bit 12 SPARE_3 0x800

*Input SEL_6 can be configured to place the machine online (default) or to remotely select a pattern.

O Message Type O resets the marker and places it online.

P Message Type P specifies the pattern name to be loaded for marking. See [DATA].

Q Message Type Q updates a specific query buffer with data supplied in the host message. See [DATA].

V Message Type V updates the variable text in a specific text field of the currently loaded pattern with data supplied in the host message. See [DATA].

[##] Optional two-digit ASCII number that specifies the Station ID of the controller when used in multi-drop network applications. The Station ID may range from 00-31. Note "00" is reserved for applications where only one controller is used. In such applications, this field can be eliminated and "00" is assumed.

STX ASCII Start of Text Character (002H).

[DATA] Optional character string that may be required for certain message types (for example, Type 1, P, Q, and V).

Data is typically sent in the format:

nn<string>.

where:

nn = two-digit field number or query text buffer where data will be placed.
Note: Not used with Message Type P.

<string> = For Message Type P, indicates the pattern name to be loaded.
For Message Types 1, Q, or V, indicates the data to be inserted into the field or the query text buffer.

ETX ASCII end of text character (003H).

BCC Optional Block Check Code that is generated and sent to improve link reliability by providing fault detection. The BCC is calculated by taking an eight-bit addition of the TYPE and DATA TEXT characters and transmitting them as a three-digit ASCII decimal number in the range from 000 to 255. If the sum is greater than 255, the most significant bit overflows and is discarded.

CR ASCII Carriage Return Character (00DH).

TRADEMARKS

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