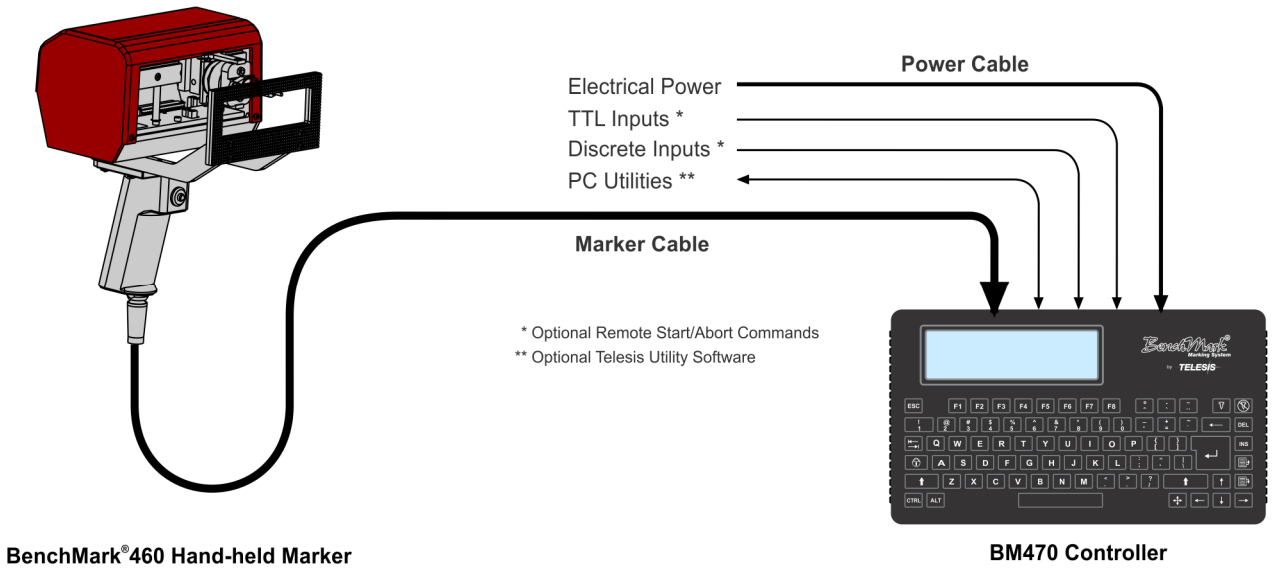


BenchMark460/BM470 Marking System – General Arrangement

SYSTEM OVERVIEW

The Telesis® BenchMark®460 marking system permanently prints messages into a variety of 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.

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 automatically controls pin extension to mark the message.

The marker uses two stepper-motor drives to rapidly and accurately position the pin at coordinate-defined locations in the marking window within 0.006 mm (0.00024"). 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.

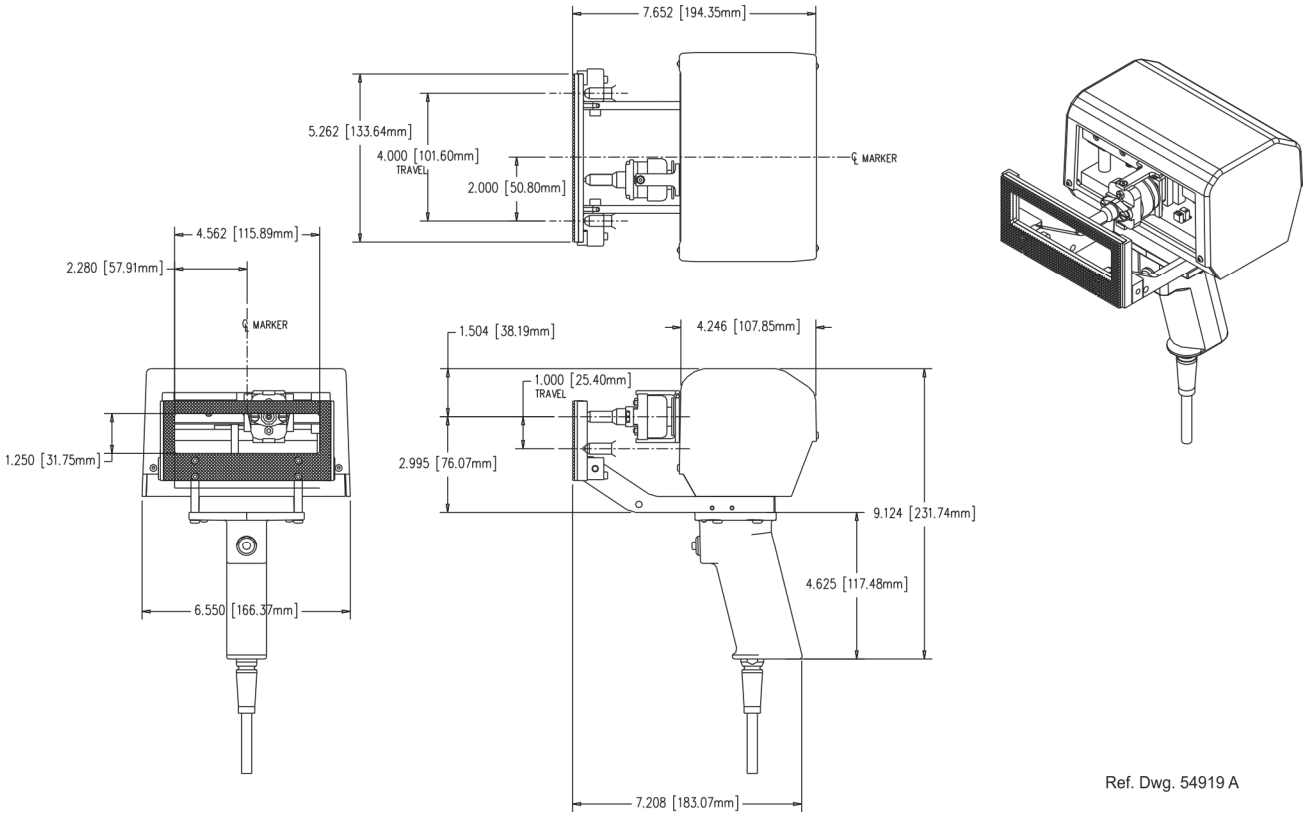
The lightweight and portable BenchMark 460 was designed for remote operation. The hand-held marker incorporates a pistol grip handle with a Start Print pushbutton switch. It can be used in virtually any orientation. The integral standoff with its padded front surface is held against the marking surface while marking. The standoff can be adjusted forward and aft to change the pin stroke.

The **Marker Cable** connects the marker to the BM470 Controller. The cable is 4 m (13 ft.) long and is pre-wired to the marking head.

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

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

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



BenchMark460 Marking Head Dimensions

SYSTEM OPTIONS

- Marking Head Extension Cables
- BM470 Controller Wall-mounting Bracket Kit
- Bar Code Scanner or Bar Code Wand with Cable
- Foot Switch (Start Print) or Pushbutton 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 vents in bottom of case. Ensure the marking system is electrically isolated from any devices that may generate extreme electromagnetic interference (EMI).

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

BENCHMARK460 MARKING HEAD

Specifications

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

Dimensions	see *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 (max); 72.5 dB (LEQ) See *Marking Noise* for details.
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")
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") in .025 mm (.001") increments. Characters can be rotated in 1° increments with printing resolutions from 5 dots/cm (10 dots/in.) to 75 dots/cm (200 dots/in.) for an engraved look.

Marking Speeds

The system will mark 2.3 characters per second (max.) using 5x7 font, 3 mm (.118") high, 2mm (.080") wide characters. Speeds will vary slightly depending on the selected character size, style, and dot density. Specific times can be verified by a Telesis representative.

Marking Noise

Sound pressure-level tests were conducted on the BenchMark460 Marking System using a Larson-Davis Model 710 sound pressure meter while dry firing the marker at a 50% duty cycle. The maximum sound pressure level during the test cycle was measured at 80.4 dB. The time-weighted average (LEQ) using the 3 db rule without threshold was 72.5 dB. Typical applications average a 20% to 30% duty cycle where the time-weighted average would not exceed 68.3 dB(A).

The sound pressure-level tests were carried out under controlled conditions, imitating as closely as possible, predicted normal operation. However, noise level is heavily dependent on the part being impacted. Conditions such as the material being marked, the rigidity of the work piece, machine settings, ambient noise, etc., may all vary when in operational use. Such variables will alter the actual noise level.

Despite detailed guidance provided with each machine, variable operating conditions are beyond the control of Telesis. The responsibility of establishing safe working levels of use remains with the end user. Accordingly, you should conduct your own sound pressure-level tests for your application while marking actual work pieces.

Marking Depth

The BenchMark460 can obtain a marking depth of .127 mm (.005") 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 that the maximum pin stroke distance is 4 mm (.15"). Specific depths can be verified by a Telesis representative.

Pin Life

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

Vibration Data

Total hand-arm vibration does not exceed 2.5 m/s^2.

Vibration tests were performed under controlled conditions imitating, as closely as possible, typical normal operation.

Conditions such as rigidity of the work piece, material, setting of the machine, etc. may vary in actual operational use and would 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 the end user. Accordingly, you should conduct your own tests to establish safe working levels of use.

The vibration tests were conducted using the following parameters:

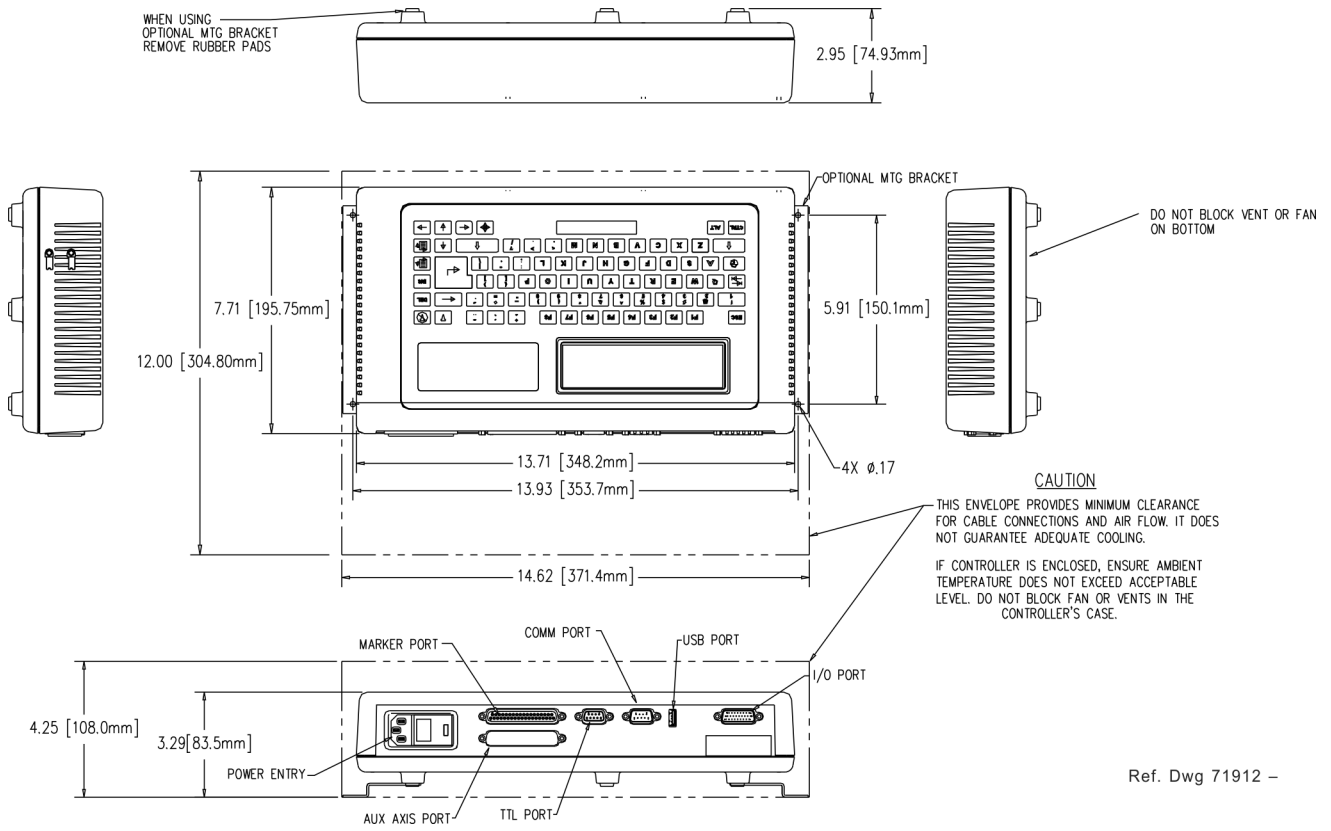
Pin Stroke	8 mm (.31 in)
Marking Base	20 mm (.79 in) thick steel
Marking Surfaces	2 mm (.08 in) thick steel plate 4 mm (.16 in) thick aluminum plate
Marking Mode	Dot
Text Marked	TELESIS (11x16 font, 5mm [.20 in] characters) HHHEEE000888 (5x7 font, 3mm [.12 in] characters)

The following test results reflect the worst-case scenarios under the given test conditions.

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.



BM470 Controller Dimensions

BM470 CONTROLLER

Specifications

The BM470 Controller specifications are subject to change without prior notice.

Compliance	CE, RoHS
Rating	NEMA 1 (I.P. 30)
Mounting Configuration	Table-top
Dimensions	see *BM470 Controller Dimensions* drawing for details
Weight	1.68 Kg (3.69 lb.) controller only
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 @ 12VDC; 4.9 mA @ 24VDC (nominal current)

* *USB for data backup & transfer*

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

BM470 CONTROLLER *(continued)*

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 (IP30). Accordingly, in environments where solid and/or liquid contaminants are present, the possibility exists that these contaminants can be drawn into the controller and possibly result in failure of a number of electronic components. 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.

Interface Panel

The back panel of the BM470 Controller provides various ports for connecting the marker and optional accessories. See below.

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/output signals to and from the controller for marker operation

TTL Port is configured for VDC input only. 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 allows connection to a remote serial device. The Comm port may be used to connect an optional, customer-supplied PC to access Telesis software utilities. Utility software may be used to backup patterns stored in the controller, to download a custom font to the controller, or to download controller software upgrades. The Comm port also allows you to connect an optional bar code scanner. The software reads the scanned input and inserts the data into a variable text field within the currently loaded pattern.

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

(optional) 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 make use of the software's Theta-axis features.

System Software

The system software is permanently installed in the controller. It provides the user interface for the operator to control the marker. 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 may be created to define text strings, arc-text strings, geometric shapes , graphics, and machine-readable data matrix symbols. Printable text fields may include alphanumeric characters, symbols, and special message flags. Message flags automatically insert data into the text string, such as serial numbers, times, dates and user-defined codes.

Non-printable objects may be defined to specify commands for the marker to execute (e.g., Go To, Print, 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 may 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 printing, stop printing, place the marker online, and monitor the system output signals. Cable connectors and connector pins are supplied with the controller for constructing appropriate interface cables.

Input Signals. These input signals provide the following controls:

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

* System software allows SEL_6 signal to be configured for remotely selecting patterns or for remotely placing the marker online. If used for marker online, pattern selection is reduced to 63 patterns (max).

Output Signals. These output signals indicate the following states:

OUTPUT COMM	For all outputs (+ or – supply)
DONE	Print cycle is complete
READY	System ready for message or for start print command
PAUSED	System 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 bar code scanner. The following describes the serial data character format for all transmissions to and from the BM470 Controller.

- 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

Host Communications *(continued)*

In addition defining Comm Port communication parameters, you can select the type of protocol to be used: *Extended Protocol* or *Programmable Protocol*.

Programmable Protocol. Use this protocol where very simple one-way communications are required (such as with bar code scanners). Programmable Protocol provides no error checking or acknowledgment of the transmitted data. Note that 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 (e.g., "2" for ASCII Start of Text "STX").

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

Character Position counted from the starting character ignoring 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 ASCII line feed character)).

Message Type allows message-type recognition which defines how the marking system will use 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 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 that host will provide message type, field number (if applicable), line number (if applicable), and data; delegates message type selection to the host on message-by-message basis. The host message must use the format:

Tnn <string>

where:

T = 1, P, Q, or V to indicate message type

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, as applicable.

BM470+ ENHANCED COMMUNICATIONS *(continued)*

Host Communications *(continued)*

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 has the ability to initiate communications. If the host does not receive a response within three seconds, it should re-transmit its original message. If no response is received after three tries, it should declare the link to be down.

The following describes the Extended Protocol message format as sent from the host to the BM470 controller.

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.
- **P** Message Type P specifies the pattern name to be loaded for printing. See [DATA] for details.
- **Q** Message Type Q updates a specific query buffer with data supplied in the host message. See [DATA] for details.
- **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] for details.
- **O** Message Type O resets marker and places it online
- **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 will return 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

Note: Input SEL_6 may be configured to place machine online (default) or for Remote Pattern Selection.

[##] 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 that "00" is reserved for applications where only one controller is used. In such applications, this field may be eliminated and "00" will be assumed.

STX ASCII Start of Text Character (002H).

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

Typically, data is 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, as applicable.

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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