

System Overview

The Telesis[®] BenchMark[®]320 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 **Marking Head** is an electromechanical marker. A thermo-formed cover houses the internal, mechanical components that position the pin cartridge and fire 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 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 0.032 mm (0.00125"). The marker accommodates the rigorous dynamics of impacting, rebounding, and rapid positioning of the marking pin through a system of rigid rails and ball bearing saddles, timing belts, and direct-drive, toothed pulleys.

The pin design permits high quality, consistent marks on irregular, slightly curved surfaces. It also accommodates applications where marking surfaces cannot be positioned at a consistent distance from the marker.

The unique design of the BenchMark320 provides liberal access for securing and positioning parts for printing. Using a gantry arm and a programmable park position, you can tuck the impact pin out of the way when the marker finishes printing. Parts can then be easily secured and removed in front of the marking head.

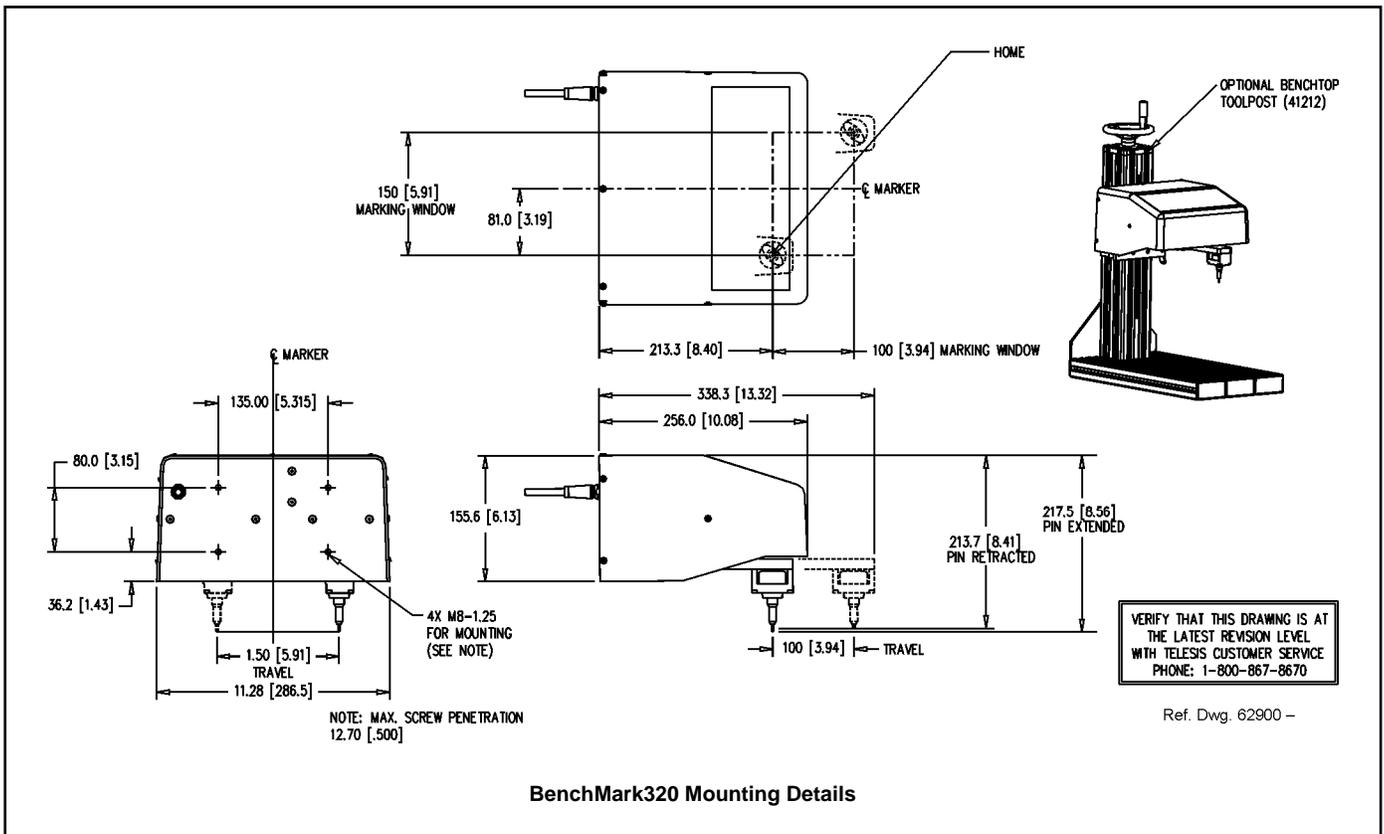
The **Marker Cable** connects the marker to the controller. The cable is 4 m (13 ft.) long and is pre-wired to the marking head.

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.

The **Controller** includes an integrated keyboard with a four line LCD display. It provides the electrical interface and software control of the BenchMark320 marking head. (Refer to *Controller Specifications* for details.)

The **Tool Stand** holds the marking head and provides a base for securing parts to be marked. It uses a screw jack with an adjustment wheel to position the marker above the marking surface. Adjustment locks secure it in place. The generous vertical adjustment accommodates parts up to 298.4 mm (11.75") high. The tool stand base contains slots to accommodate part fixtures. The tool stand comes with two 8mm T-nuts to aid in securing the parts for marking.



BenchMark320 Mounting Details

System Setup

1. Position tool stand assembly in desired location.
2. Mount marking head to tool stand assembly using four M8-1.25 socket head cap screws. **Screws must extend into the back plate at least 9mm (0.375 in.) but not more than 12.7mm (0.5 in.).** See *Mounting Drawing* (above) for details.
3. Adjust pin stroke for proper pin impact depth.

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

4. Locate controller as close as practical to marking head. Standard marker cable length is 4 m (13 ft.).
5. Ensure controller power switch (on back panel) is OFF; connect power cable to controller.
6. Connect marker cable from marking head to controller; tighten securely.
7. Position controller power switch to ON (on back panel) to start the marking system software.

System Options

- Controller Mounting Bracket Kit
- Foot Switch (Start Print)
- Pushbutton Station (Start/Abort)
- RD3 and RD5 Theta Axis Rotational Fixtures
- Bar Code Scanner
- Backup Utility Software
- Upgrade Utility Software
- Logo/Font Generator Software
- BenchMark+ Enhanced Communications

BenchMark320 Marking Head

Specifications. The BenchMark320 marking head specifications are subject to change without prior notice.

DIMENSIONS	refer to <i>BenchMark320 Mounting Details</i>
WEIGHT	6.39 Kg (14.055 lb.) marking head and cable 5.84 Kg (12.865 lb.) marking head only 16.0 Kg (35.200 lb.) tool stand only
OPERATING TEMP.	0° to 50° C (32° to 122° F), non-condensing
MARKING AREA	150 x 100 mm (6.0 x 4.0")
PIN TYPES	25XLE-series
PIN MATERIAL	Tungsten Carbide

BenchMark320 Marking Head *(continued)*

Marking Characteristics. The BenchMark320 can accommodate character sizes from .762 to 100 mm (.030 to 4.0") 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. Generally, the system will mark three characters per second 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. When marking a cold-rolled steel strip, the noise level of the BenchMark320 has been measured to be 74.9 dB, using the LEQ approach. It is expected that under any reasonable duty rate, the equivalent continuous A-weighted sound pressure level will not exceed 70 dB(A).

Noise-level Tests have been carried out under controlled conditions imitating as closely as possible predicted normal operation. Conditions such as rigidity of the work piece, material, setting of the machine, ambient noise, etc. may vary when in operational use and would alter the actual noise level.

Despite detailed guidance notes provided with each machine, these conditions would be out of the control of Telesis and must remain the responsibility of the end user to conduct their own tests to establish safe working levels of use.

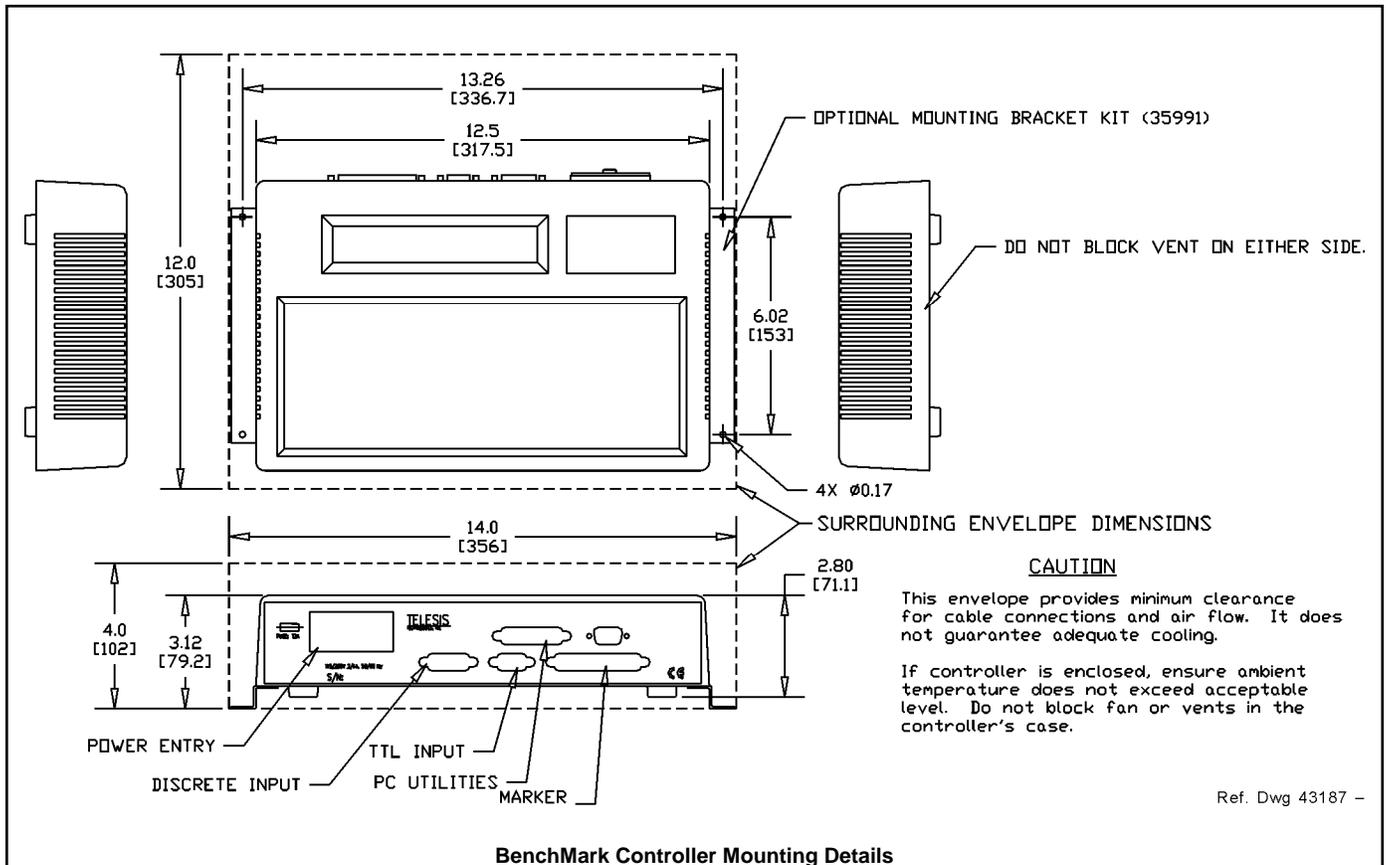
Pin Life. Pin life depends largely on the type of material being marked, how hard or abrasive it is, and the required marking depth. On typical metals with a hardness of Rockwell Rb47, marking at a depth of .127 mm (.005"), carbide pins average approximately 9 million impressions before needing sharpened.

Marking Depth. The BenchMark320 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 (via software parameter) or by changing the impact distance (pin stroke). Specific depths can be verified by a Telesis representative.

BenchMark Controller

Specifications. The BenchMark controller specifications are subject to change without prior notice.

DIMENSIONS	refer to <i>BenchMark Controller Mounting Details</i>
RATING	NEMA 1 (I.P. 30)
WEIGHT	2.15 Kg (4.75 lb.)
OPERATING TEMP.	0° to 50°C (32° to 122° F), non-condensing
REQUIRED POWER	95-130 VAC, 2 amps, 50-60 Hz single phase 200-250 VAC, 1 amp, 50-60 Hz single phase
INPUT SIGNALS	12 to 24 VDC (optional, customer-supplied)



BenchMark Controller *(continued)*

Environmental Considerations. The following environmental considerations must be taken into account when installing the BenchMark 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.

Back Panel. The power entry module contains fuses for circuit protection and connects the controller to facility electrical power. The back panel also provides a Marker port for connecting the marking head and an Aux Axis port for connecting an optional Telesis rotary drive (Theta Axis) fixture.

Input Control Signals. The controller is configured for VDC input only. The TTL Input port may be used to connect a remote foot switch or remote pushbutton station for Start Print commands. The Discrete Input port may be used for remote Start Print and Abort signals. Cable connectors and connector pins are supplied with the controller for constructing appropriate interface cables.

START PRINT	Input signal, begins print cycle
ABORT	Input signal, aborts print cycle
INPUT COMM	For all inputs (+ or – supply)

System Software

The marking 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 memory. The controller can store up to 75 patterns. Each pattern contains one or more fields. A field defines a single object and how it will be printed. Fields may define text strings, arcs, arc text strings, Go-To or Pause commands, or machine-readable data matrix symbols. Text fields may include alphanumeric characters, symbols, and special message flags. The message flags automatically insert data into the text string, such as serial numbers, times, and dates.

PC Utilities. The Host port on the controller back panel is used for connecting to 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.

Bar Code Scanner Interface. The Host port also allows you to connect an optional bar code scanner. When the bar code scanner interface is used, the marking system reads the scanned data from the bar code, then inserts it into the variable text field of the current pattern. If more than one variable text field exists in the pattern, the operator must select which field is to receive the data.

BenchMark+ Enhanced Communications

The BenchMark+ Enhanced Communications option allows you to use the controller's input/output signals and host communication capabilities to remotely control the marker.

The I/O port allows you transmit I/O signals between the controller and a remote I/O device. The I/O device can remotely select patterns to be loaded and start or abort the marking cycle. Output signals from the marker may be transmitted to the I/O device to report its status.

The TTL I/O port allows you to start printing operations using a Programmable Logic Controller (PLC) or by connecting a simple START PRINT contact closure.

The Host port allows an RS-232 device to transmit data, select patterns for printing, and control the marker operation. Optionally, the host interface supports RS-485 communications for networking multiple markers to the same controller.

I/O Control Signals. The TMC420 is configured for DC I/O only. The TTL I/O Port may be used to connect a remote pushbutton control for Start Print and Abort commands. The I/O Port may be used to connect a PLC or other DC I/O source. The I/O Port allows remote control of pattern selection, printing, aborting, placing the marker online, and monitoring of the Ready and Done output signals. Cable connectors and connector pins are supplied with the controller for constructing appropriate interface cables.

START PRINT	Input signal, begins print cycle
SEL_0, 1, 2, 3 *	Input signals, remote pattern selection (15* max.)
SEL_3 *	Input signal, marker online
ABORT	Input signal, aborts print cycle
INPUT COMM	For all inputs (+ or – supply)
READY	Output signal, ready for message or start print
DONE	Output signal, print cycle complete
OUTPUT COMM	For all outputs (+ or – supply)

* System software allows SEL_3 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 7 patterns (max).

Serial Interface. The Host Port is used for RS-232 and RS-485 communications with serial devices such as a host computer or bar code scanner. Up to 31 controllers may be used in a multi-drop configuration using the RS-485 interface. The host computer can load patterns, download messages, place the marker on/offline, and monitor system errors. (See *Serial Communications* for details.)

Serial Communications. The Host Port may be used for either RS-232 or RS-485 communication. The RS-232 interface is most often used with remote devices such as bar code readers or host computers. The RS-485 interface is normally used for long transmission distances or multi-drop networks of up to 31 TMC420 controllers. The serial port may be configured to communicate using either the Telesis Programmable Protocol or Telesis Extended Protocol. The following describes the serial data character format on all transmissions to and from the TMC420 controller.

- Asynchronous
- 1200, 2400, 4800, 9600, or 19200 baud-host
- One Start Bit
- One or Two Stop Bit(s)
- Seven or Eight Data Bits
- None, Even or Odd Parity

Programmable Protocol is used 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 ASCII decimal format such as 2 for STX.

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

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 ASCII line feed character, decimal 10).

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

- P** loads a specific pattern identified by data extracted from host
- V** updates first variable text field with data extracted from host
- 1** overwrites first text field with data extracted from the host
- Q** updates text in first query buffer with data extracted from host
- 0** indicates that host will provide message type, field 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** = P, V, 1, or Q to indicate the message type.
 - nn** = two-digit number to indicate field number or query text buffer where data will be placed. Note that a number is not used with Message Type P.
 - <string>** = pattern name (Message Type P) or field data (Message Types V, 1, or Q), as applicable.

BenchMark+ Enhanced Communications *(continued)*

Extended Protocol includes error checking and transmission acknowledgment. It should be used in applications where serial communication is a vital part of the marking operation. Extended Protocol must be used in multi-drop applications.

All communications are carried out in a master-slave relationship with the host being the master. Only the master 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 message format as sent from the master to the TMC420 controller.

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

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** overwrites the specified field of currently loaded pattern, using the format **1nn<string>** where nn is the field number.
- V** updates specified variable text field of currently loaded pattern, using the format **Vnn<string>** where nn is the field number.
- Q** updates specified query buffer with the data received from host, using the format **Qnn<string>** where nn is the buffer number.
- P** specifies pattern name to be loaded for printing
- O** resets marker and places it online
- G** initiates a print cycle to mark the currently loaded pattern
- I** requests the marker output status; returns a single-digit hexadecimal value to report state of READY and DONE:

RETURNED VALUE	DONE	READY
0	off	Off
1	off	ON
2	ON	Off
3	ON	ON

TYPE *(continued)*

- S** requests the marker error status; returns a value that represents a particular type of error:

RETURNED VALUE	TYPE OF ERROR
0x0000	(no error)
0x0001	ONLINE_ERROR
0x0002	PATTERN_LOAD_ERROR
0x0004	DISALLOWED_NO_PATTERN
0x0008	DISALLOWED_OFFLINE
0x0010	PATTERN_FIELD_ERROR
0x0020	MARKER_ABORTED_ERROR
0x0080	PIX_OUT_OF_RANGE_ERROR
0x0100	RAM_ERROR
0x0200	SN_RANGE_ERROR

[##] Two optional ASCII decimal digits that specify the Station ID number for use in multi-drop network applications. The 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 TEXT] Optional field that may be required for certain message types.

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).

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