MR 100
User Manual

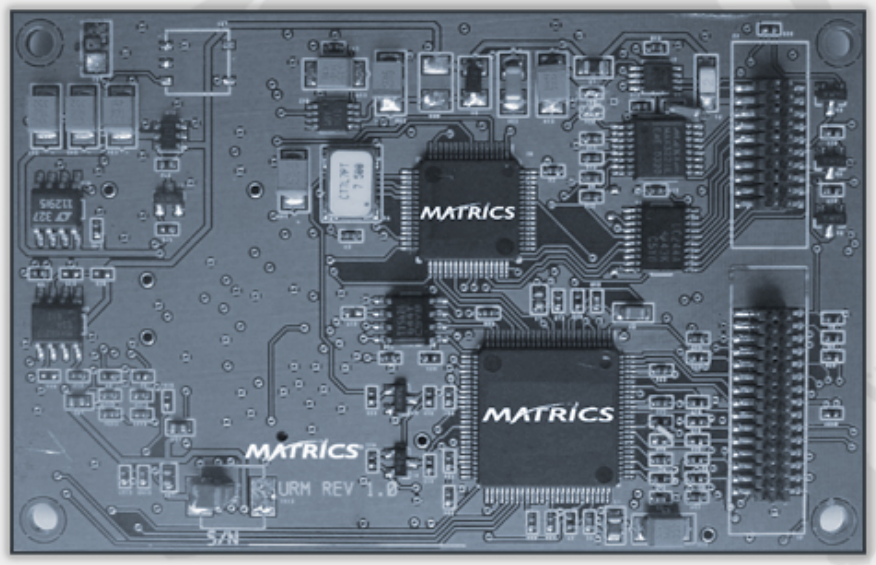

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Table of Contents

Chapter 1. INTRODUCTION

1.1. Scope

The Symbol MR100 Reader User Manual provides the following information pertaining to Symbol MR100 Receiver Module:

- Hardware Specifications and details.
- Supported API calls.

1.1.1. Target Audience

This guide is targeted for developers who will be writing code that interfaces with MR 100 reader using the Byte Stream Protocol.

1.1.2. Assumptions

This manual assumes that besides being familiar with windows based environment you also have a basic idea of the following:

- Basic RFID concepts and terminologies.
- Proficieny with atleast one programming language which is capable of accessing the MR 100 API.
- Basic networking terms e.g. IP Address, DHCP, Protocol etc.

The manual does not contain detailed information and material on the above-mentioned topics.

1.2. Document Organization

This document has been organized as described in the table below:

Chapter No.	Chapter Title	Information Contained in the Chapter
1	**Introduction**	An overview of what the Document contains, who the targeted audience is and how the document is organized.
2	**An introduction to MR 100**	A brief description of the Product and its features.
3	**Byte Stream Protocol with MR 100**	A Basic introduction to byte stream protocol and how it can be used to interface with the MR 100 Reader.
4	**Supported APIs**	Specifications of API supported by Symbol MR 100 readers.
Appendix A	**Hardware Specifications**	Hardware specifications and details of reader interfaces.
Appendix B	**Physical Dimensions**	Physical Dimensions of the MR 100

1.3. Document Conventions

The following Conventions have been used in this Guide:

Document Convection	Version
▪ Bulleted List	Provides Grouped Action and non procedural steps
1. Numbered List	Procedural steps for performing an action.
	A Note / Focus point that the reader might be interested in knowing.
	A Warning Note.
	A Caution Note.

1.4. Abbreviations

The Following acronyms and abbreviations have been used in the System Manual:

Acronym / Abbreviation	Expansion / Explanation
RFID	Radio Frequency Identification
EPC	Electronic Product Code - industry-driven standard of identification scheme for RFID Tags.
Read Point	An individually addressable antenna
Read Point Class	Configuration Parameters that may be applied to one or more read points

1.5. Additional Documentation Available

The following additional documentation may be useful to the users of this manual:

- Matrics API Programmer's Manual (PN: 110009-001).
- MR 100 Data Sheet.
- http://www.symbol.com (for FAQ and Product Updates)

Chapter 2.
An Introduction to MR 100

The Symbol RF Receiver Module or MR 100 is a single port, lightweight reader designed for easy integration with RFID printers, handhelds and applicators[1]. This chapter describes some of the important features of MR 100.

2.1. MR 100 Features

2.1.1. Designed for Embedded Applications

The Symbol MR 100 offers a simplified design and better utilization of board space, which results in a small and lightweight device that can be used very effectively in embedded systems.

2.1.2. Robustness

The MR 100 Reader is highly robust and can be used in environment with extreme temperatures and humidity. It is capable of functioning from temperatures ranging from –20^{D}C to +60^{D}C and 5% to 95% humidity.

2.1.3. Performance

The MR 100 uses a Symbol patented interrogation protocol, which makes it capable of Read rates of up to 200 tags per second. The same protocol also enabled it to work in noisy environments.

The MR 100 has a read range of up to of 10+ feet, and a write range of up to 4+ feet. The range however, depends on factors like Antenna Gain, interference and traffic.

2.1.4. Support for Industry Standards

The MR 100 provides all RF and control functions that are required for powering and communicating with industry standard UHF passive tags. It has capabilities of interacting with both Class 0(Read Only) and Class 0 (Read Write) tags

2.2. What's shipped

The customer has multiple options to choose from while purchasing the MR100.

- **Host Interface** → the JST 14-Pin Connector can be used to connect the MR 100 to devices. the customer can choose between RS 232 (serial) or TTL interface depending on the device to which the MR 100 will be connected to.
- **Antenna Port** → depending on, what the MR 100 needs to be deployed for, the customer has an option of purchasing the single antenna port version (which uses the same antenna for both transmissing and receiving) or dual port (which allows the use of separate antenna for transmitting and a separate antenna for receiving).

[1] With appropriate regulatory certifications

2.3. Product Pictures

Board View

Top View

2.4. Basic Connections

Connecting the MR 100 to your system is fairly easy and includes a simple two step process:

- **Connect the MR 100 to the device** you plan to use with the reader using the JST 14-Pin Connector. Depending on the device you wish to connect to you should select between the RS 232 / TTL interfaces before ordering your MR 100.
- **Connect the MR 100 antenna port to your antenna**: If you are using a MR 100 with a dual antenna port connect one to a transmitting and 1 to a receiving antenna. If you are using a MR 100 with a single antenna port connect the antenna port to the antenna – in this case the single antenna acts as a transmitting and receiving antenna. Your choice of antenna will vary depending upon the read write distance that you want with your MR-100. e.g. For a typical read range of 10' and a write range of 4' an antenna of 6dBi gain must be selected.

Chapter 3.
Byte Stream Protocol with MR 100

This chapter gives a brief introduction to Byte Stream Protocol and how it can be used to communicate with the MR 100 reader. If you are looking for more details of Byte Stream Protocol and how it can be used with other Symbol Readers refer to *Matrics API Programmers Manual*.

3.1. Byte Stream and MR 100

Byte stream protocol can be used to send data to the host using a 2 wire serial link (RS-232) or TTL as factory option at the following Baud Rates:

- 19200
- 38400
- 57600
- 115200

3.2. Generalized Request and Response Packets described

The byte stream packet follows generalized packet format for request and response packet. This section describes the packet format which most request and response examples in this document will use. In practical implementation, most of the times, these packets are arrays of bytes where elements are arranged as per specified format.

A general **request packet** that is being sent to MR 100 over host interface must be formatted as follows:

Field	Number of Bytes (Size)	Value	Description
SOF	1	0x01	Start Of Frame
Node Address	1	0~0x1F	i.e. 0 to 31. Node address that had been set on the reader
Packet Length	1	See Description	Size of the packet that is being sent. This should **not** include the size of SOF but should include the size of CRC.
Command	1	See Description	Each Reader API Command corresponds to a number. This number tells the reader which command to fire. Populate this byte with the value of the command which you want the reader to fire.
Data	Variable	See Description	Depending upon the command you are executing you may need to send different number of bytes formatted differently. See the definition of the command you want to execute for more details. A Typical Request data packet can be 0 to 64 bytes.
CRC	2 (1 for LSB & 1 for MSB)	Dependent	Bitwise inversion of the 16-bit CCITT-CRC of the packet excluding SOF, with the LSB (Least Significant Byte) first.

For every request sent to the reader there may be one / more response packets that the reader sends back to the host. A Typical **Response Packet** has been described in the following table:

Field	Number of Bytes (Size)	Value	Description
SOF	1	0x01	Described in Request Packet description.
Node Address	1	0~0x1F	Described in Request Packet description.
Packet Length	1	See Description	Described in Request Packet description.
Command Mirror	1	See Description	Mirror of the original command in the response packet.
Status	1	See Description	The result or status of a command execution. See **Status Field Description** section for more details.
Data	Variable	See Description	In a typical response packet the size of data field may vary from 0 – to 250 bytes. The first byte of response data usually contains the error code if error bit of status field has been set. For more information on error bit see **Status Field Description** section. For more information on error codes see **Error Codes Described** section.
CRC	2 (1 for LSB & 1 for MSB)	Dependent	Bitwise inversion of the 16-bit CCITT-CRC of the packet excluding SOF, with the LSB (Least Significant Byte) first.

For more information on the Byte Stream Protocol section of the *Matrics API Programmers Manual*.

Chapter 4.
Byte Stream Command List

Below is a listing of all commands that are supported by the MR 100 reader. For more information of how to use each command refer to the *Matrics API Programmers Manual*.

4.1. Read Full Field Command (22_{hex})

Read all RFID tags using one antenna port of the addressed reader. With the MR 100 you can use this command to read tags using the first and only antenna port of the reader. Other antenna ports (2-4) should **not** be used while using the command with the MR 100. For more information on this command refer to the *Matrics API Programmers Manual*.

4.2. Set Parameter Block Command (23_{hex})

Set parameters related to the first and only antenna port of the address MR 100 reader. For other readers this command is capable of initializing more than one antenna simultaneously. However, for MR 100 only the first antenna port must be initialized.
While using this command also ensure that you do not use combination features since MR 100 supports only one antenna and does not support combination. For more information on this command refer to the *Matrics API Programmers Manual*.

4.3. Get Parameter Block Command (24_{hex})

Get parameters for one specific antenna port. For the MR-100 this command should be used only by passing the logical indicator of the first (only) antenna in the request packet. For more information on this command refer to the *Matrics API Programmers Manual*.

4.4. Set Node Address Command (12_{hex})

For more information on this command refer to the *Matrics API Programmers Manual*.

4.5. Get Reader Status Command (14_{hex})

For more information on this command refer to the *Matrics API Programmers Manual*.

4.6. Set Suspend Mode Command (18_{hex})

For more information on this command refer to the *Matrics API Programmers Manual*.

4.7. Get Node Address Command (19_{hex})

For more information on this command refer to the *Matrics API Programmers Manual.*

4.8. Set Baud Rate Command ($1D_{hex}$)

With MR 100 this commands supports a maximum baud rate of 115200 bps. For more information on this command refer to the *Matrics API Programmers Manual.*

4.9. Read With Payload Command (31_{hex})

Only the first antenna port must be passed in the request packet while using this command with the MR 100 reader. No Antenna combination options should be used with this command when using it with the MR 100 since the MR 100 does not support combination of antennas. For more information on this command refer to the *Matrics API Programmers Manual*.

4.10. Kill Specific (32_{hex})

This command can be used to kill a tag using the MR 100 to ensure that it is not read with further read operations. While using this command with MR 100 always use the first antenna port of the reader while forming the request packet. For more information on this command refer to the *Matrics API Programmers Manual*.

4.11. Write Tag (33_{hex})

While using this command with MR 100 always use the first antenna port of the reader while forming the request packet. For more information on this command refer to the *Matrics API Programmers Manual*.

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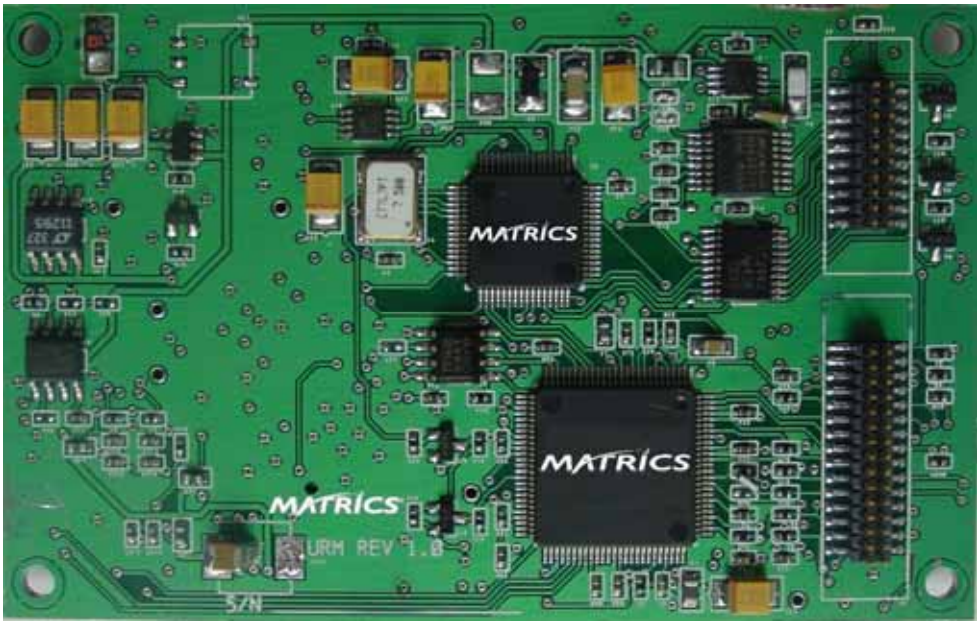
Device Specifications



A. Hardware and Technical Specifications

This section describes in details the specifications of hardware interfaces that are used with Symbol MR-100 Readers.

A.1. Physical Dimensions

Dimensions	Length 3.4" x Width 2.1" x Height 0.3" (85.6 mm x 54 mm x 8 mm)
Weight	~ 2.5 Ounces (70 Grams)
Visual Status Indicator	On-board LED for Radio On/Off indication

A.2. Power

Power Supply	+6vDC @ 1.2 Amp (Regulated)
Operational Power Consumption	4.8 Watts (800 mA @ 6V)
Idle Power Consumption (for Hot Standby)	300 mW (50 mA @ 6V)

A.3. Environmental

Condition	Standard	Value	
Temperature	IEC 60068-2-1/2/14	Operational:	-20° to +60° C (-4° to +140° F)
		Storage:	-40° to +85° C (-40° to +185° F)
Humidity	IEC 60068-30/56	5-95% Non-condensing	
Vibration	IEC 60068-2-6	Mechanical (also MIL-STD-202 - 213/B) Sinusoidal (also MIL-STD-202 - 204/B) Random (also MIL-STD-1344 - 2005)	

A.4. Connectivity

Connector Type	JST 14-Pin Connector (Part Number: JST SM14B-SRSS-TB)	
Operational Power Consumption	Factory Option:	Serial or TTL
	Data Rate:	Variable 19.2 / 38.4 / 57.6 and 115.2
	Data Structures:	8 Data / 1 Stop / No Parity / No Flow Control
RF Connector	U.FL (Low Profile 1.9 mm Height, 0.81 mm Dia) Coaxial	

A.5. Interface Pin Outs

Pin Number	Signal	Dir	Description
Pin 1:	VIN	I	Regulated +6Vdc (min/max 5.4v/7v), 1.2A max, 2A fused
Pin 2:	VIN	I	Regulated +6Vdc (min/max 5.4v/7v), 1.2A max, 2A fused
Pin 3:	GND	I	Ground
Pin 4:	GND	I	Ground
Pin 5:	GPIO_1	I/O	General purpose input or output #1, 3.3V TTL, configurable via board stuff-in option, default to input.
Pin 6:	GPIO_2	I/O	General purpose input or output #2, 3.3V TTL, configurable via board stuff-in option, default to input
Pin 7:	GPIO_3	I/O	General purpose input or output #3, 3.3V TTL, configurable via board stuff-in option, default to input
Pin 8:	GPO_0	O	General purpose output #0, 3.3V TTL
Pin 9:	GPI_0	I	General purpose input #0, 3.3V TTL
Pin 10:	RS-232-RxD	I	RS-232 Receive Data, configurable as host interface via board stuff-in option
Pin 11:	RS-232 TxD	O	RS-232 Transmit Data, configurable as host interface via board stuff-in option
Pin 12:	GND	I	Ground
Pin 13:	TTL-RxD	I	3.3V TTL Receive Data, 5V tolerant, default host interface
Pin 14:	TTL-TxD	O	3.3V TTL Transmit Data, 5V tolerant, default host interface

A.6. Operational Features

Frequency	UHF band, 902-928 MHz
Method	Frequency Hopping Spread Spectrum (FHSS); Host controlled On/Off of FH
Power Output	Max 1 Watt (30 dBm, host adjustable in steps of 0.1 dB)
Read Range	Typical 10' (in free space using an antenna with 6 dBi gain)
Write Range	Typical 4' (in free space using an antenna with 6dBi gain)

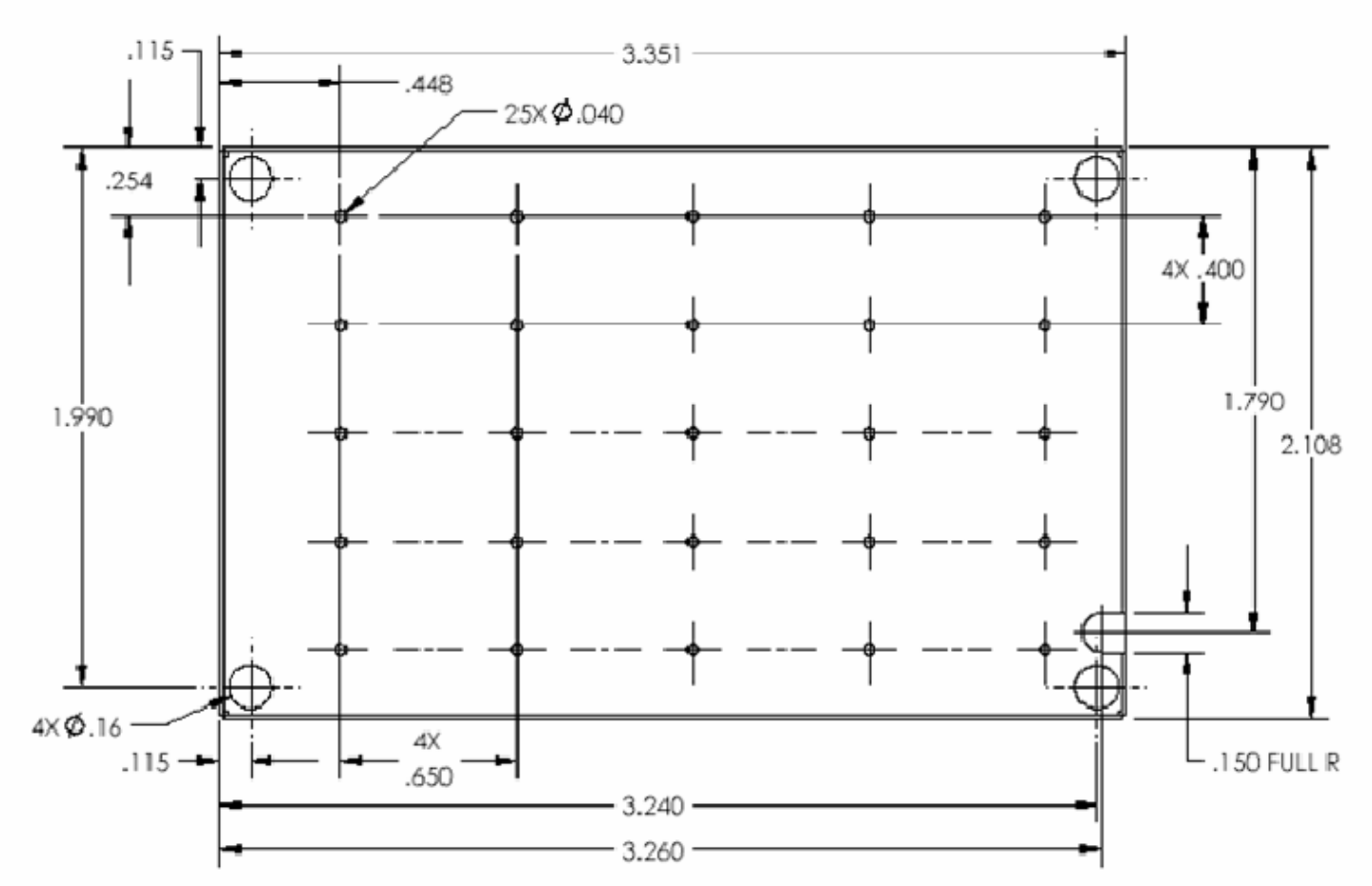
A.7. Compliance

Safety	EM / RF Emissions
Regulatory	Region 1, FCC Part 15

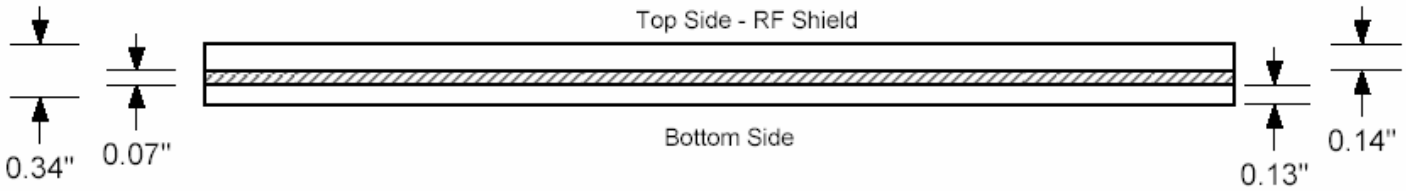
B. Physical Dimensions

This section provides detailed diagram physical dimensions of the MR 100.

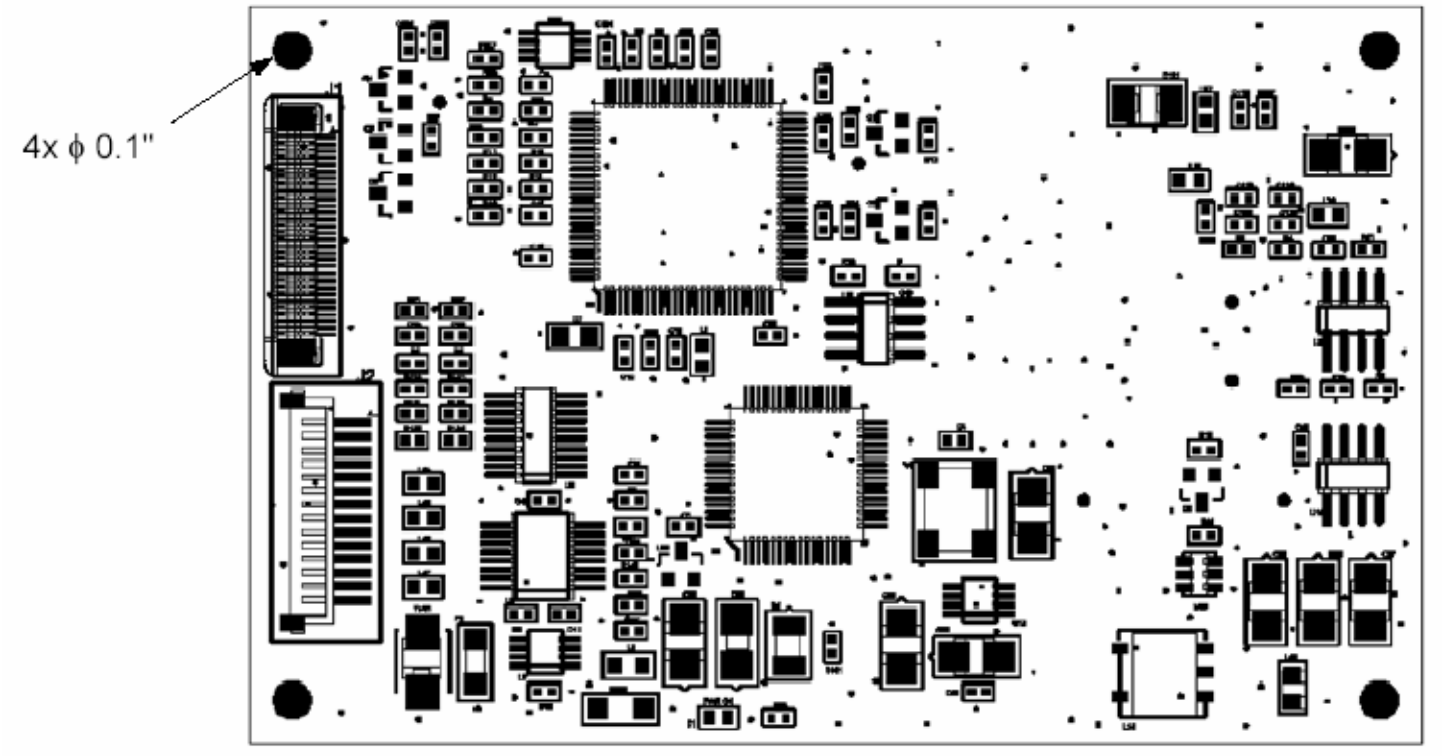
B.1. Top View



B.2. Side View



B.3. Bottom View



Note: Unit Of Measurement used in above diagrams is inches.

C. Compliance & Regulatory Information

All Symbol devices are designed to be compliant with rules and regulations in locations they are sold and will be labeled as required.

Any changes or modifications to Symbol Technologies equipment, not expressly approved by Symbol Technologies, could void the user's authority to operate the equipment.

Antennas: Use only the supplied or an approved replacement antenna. Unauthorized antennas, modifications, or attachments could cause damage and may violate regulations.

FCC RF Exposure Guidelines

C.1. Safety Information

The device complies with Internationally recognised standards covering Specific Absorption Rate (SAR) related to human exposure to electromagnetic fields from radio devices.

C.2. Reducing RF Exposure

It is advisable to use the device only in the normal operating position and it is recomended that no part of the human body be allowed to come too close to the antenna during operation of the equipment. The unit has been evaluated and found to comply with the required Maximum Permissable Exposure limits at 20cm.

C.3. Hand Held / Wrist Worn Devices

This device is not certified for use as is in handheld devices. Such use will require additional testing and certification.

C.4. Radio Frequency Interference Requirements-FCC

Note: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be

determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna
- Increase the separation between the equipment and receiver
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected
- Consult the dealer or an experienced radio/TV technician for help.

C.5. Radio Transmitters (Part 15)

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

C.6. Radio Frequency Interference Requirements – Canada

This Class B digital apparatus complies with Canadian ICES-003.
Cet appareil numérique de la classe B est conforme à la norme NMB-003 du Canada.

Radio Transmitters
This device complies with RSS 210 of Industry & Science Canada. Operation is subject to the following two conditions: (1) this device may not cause harmful interference and (2) this device must accept any interference received, including interference that may cause undesired operation.

Label Marking: The Term "IC:" before the radio certification only signifies that Industry Canada technical specifications were met.

C.7 Regulatory

Symbol's devices are designed to be compliant with rules and regulations in locations they are sold and are labeled as required.

Any changes or modifications to Symbol Technologies equipment, not expressly approved by Symbol Technologies, could void the user's authority to operate the equipment.

Final Product Compliance

Final product will require Regulatory approvals; these include Product Safety, EMC, and SAR etc. As the integrator it is your responsibility to comply with these requirements for each country in which the product is sold. The compliance process may include submittal of prototype products for test purposes. Be prepared, the certification process for your product may take from a few weeks to several months. Symbol advises the use of an accredited test laboratory for advice and testing or the final product.

United States

This module is approved for integration; to maintain the approval the integrator must address the following:

- FCC Part 15 (emissions class B) required for the final product
- SAR testing required on final product (Note: If final product, in normal usage, is operated more than 20cm from the human body, MPE testing is required instead of SAR)

Final product markings must include:

• Contains FCC ID: H9PMR100A

Canada

In complying with the requirements for the FCC, this device also complies with all the technical requirements of the Canadian Interference-Causing Equipment Regulations (ICES-003).

Final product markings must include:

• Contains IC: 1549D-MR100A