CONTROL CHIEF®

WIRELESS SOLUTIONS

Communicator® 2410

User's Guide

Failure to return the Warranty Registration document (enclosed) to Control Chief within 30 days of purchase will void any warranty responsibilities on behalf of Control Chief Corporation

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Introduction

The wireless Communicator® module is designed to provide a dedicated medium for the transfer of data from SLC to SLC without the latency and overhead of traditional methods. The Communicator® is set up and utilized in the same fashion as a standard I/O module. Once identified in the RS Logix 500 I/O configuration, the slot in which the module resides is allocated both an input and output image table up to 32 words in length. Any of the modular designed SLC processors can be integrated with the Communicator® module (SLC 5/01 through 5/05).

Unlike conventional serially connected RF devices that communicate with PLC processors, the Communicator® does not utilize any additional hardware or software for setup or operation. By not relying on the serial connection for access to the PLC, eliminating the need for a proprietary software, and mimicking the connection of standard I/O modules, the Communicator® can seamlessly provide a deterministic control link that eliminates the need to hard-wire between SLCs.

Whether the application is a SCADA environment where large amounts of data are being transmitted or a control environment where data latency is critical, the Communicator® module from Control Chief Corporation is the preferred RF choice of experienced SLC 500 programmers.

Specifications

Backplane power requirements:

Catalog Number	5VDC	24VDC
1746cccIWCM2410	260 mA	0 mA

Physical Description

These modules incorporate transceivers in the 2.4 GHz band. The tasks of the module are to configure the transceiver, obtain data from the SLC processor via the backplane, create data packet to send via RF, process the recovered data packet, verify and format the received data, and then present the validated data to the SLC processor via the backplane. The module front panel contains status indicators, DIP switches, an access port and antenna connector.

Indicator LED Definition and Function

Indicator	Definition	Function
LINK	Link Status	Indicates an established communication link between modules. The RD indicator should also be flashing to show valid data is being processed
TD	Transmit Data	The Transmit Data LED indicates when the module is sending data.
RD	Received Data	The Receive Data LED flashes ON to indicate when a VALID packet has been processed.
FAULT	Fault	The Fault LED provides an indication of module error conditions.

Access Port

The function of the access port is to provide serial connection for factory diagnostics and factory module configuration.

Front Panel DIP Switch Settings

The two groups of 8-position DIP switches provide convenient module configuration and setup for a specific application.

Installation

The Communicator® module can reside in any slot in the SLC 500 chassis with the exception of the first slot (this slot is reserved for the processor or the ASB module).

1. Remove and lock out power to the SLC chassis.

2. Align the printed circuit card edges with the guides in the SLC rack.

3. Slide the Communicator® module in until the tabs on top and bottom of the plastic card housing lock into the rack.

4. Attach one end of the 3m antenna extension cable to the module by threading it onto the antenna connector.

5. Attach opposite end of cable through pre-drilled 3/8" hole in enclosure and secure with lockwasher and nut provided.

6. Attach 2-dB dipole antenna to threaded portion of cable connector extending to exterior of enclosure.

7. Cover all unused slot positions with card slot filler, catalog # 1746-N2 (available at your local Allen-Bradley distributor).

I/O Configuration

1. Open I/O configuration table through RS Logix 500 Software. (Consult your Allen-Bradley distributor for assistance with this product).

2. Select "other" from the list of available modules on the right.

3. Enter appropriate code as determined from chart in Appendix D. (page 14)

4. Enter 60 in box for "G-File Size" (even if the G-File won't be used). View the G-data. Change radix to Hex/BCD. Change location 1 to A55A.

Module Networking

Base/Remote Topology

The model 2410 Communicator® module utilizes base/remote topology in its communication scheme. One module, configured as the base, initiates all communication with all remote modules. Remote modules can only communicate with the base, and only after acquiring the signal from the base module. A remote module can only gain data from another remote if the information is passed through the base module. Through the advent of spread spectrum frequency-hopping technology, a total of 16 base modules can operate simultaneously in the same geographical environment, even within the same rack. Each base can communicate with up to 16 remote modules. There are certain limitations involved with each of these arrangements, and complex network layouts should be discussed with a Control Chief Application Engineer.

Point to Point

When the module is used in a point to point scenario, the base will share a total of 64 words of I/O with the remote module. Each SLC 500 CPU in this configuration can have up to 32 words of input and 32 words of output allocated to the image tables of the 2410 Communicator® module. The output data table from the base module's PLC will be sent through the base module, to the remote module. The remote module will communicate these words to the PLC and store them in the remote's input image table. In turn, the output image table from the remote's PLC will be sent to the base unit. The base unit's PLC will store those 32 words in its input image table. Round-trip latency (Base->Remote->Base) for a point-to-point configuration (Base and 1-Remote): typically 115-mSec, maximum 150-mSec.

1 Base to up to 16 Remotes

The base Communicator® module can network with up to 16 remote Communicator® modules. However, a large network will have some practical limitations. The more remote units there are communicating with the base, the more time it will take for the base to complete the communication cycle with all remote units.

I/O Allocation

As stated earlier, each module can allocate up to 32 input words and 32 output words from the local CPU. The base shares these words of scanned I/O with the remote units. The base unit can be configured to determine how many words of I/O to allocate to each remote unit. In a point to point scenario (one base, one remote), as many as all 32 input words and all 32 output words, or as few as 2 input words and 2 output words can be shared between base and remote. In a multiple remote network scenario (from 2 to 16 remotes), the base must divide the 32 input and output words with the remotes. At least 2 words must be shared with each remote in the network.

Configuration

Configuring with DIP switches:

CPU Switch 1
Switch 1 selects which CPU style is in the rack. If the CPU is a 5/01 (1747-L511 or 1747-L514) then switch 1 must be set on. If any other processor is used, switch 1 must be set off.

Diag/Norm Switch 2
Switch 2 is always set off (normal mode).

Base/Remote Switch 3
Switch 3 is set on if module is to act as a base radio or off if module is to act as a remote radio.

Power Switch 4
Switch 4 is set on for low radio transmission power (10 mw) or off for high radio transmission power (100 mw).

Network Switches 5 + 6
Network switches 5 + 6 are set the same for a particular base and all remotes that will communicate with that base. Remotes will only communicate with one base, and only with the base whose switches 5 + 6 are set the same as switches 5 + 6 on the remote.

Configuration Switches 7 + 8
When using the SW2 DIP switch on the front of the module for configuration, these switches must be set the same on the base and all remotes within the network.
The configuration switches on the base determine the number of remotes the base will access within the network (up to four) as shown below.

Number of remotes	Switch 7	Switch 8
1	Off	Off
2	Off	On
3	On	Off
4	On	On

When setting configuration switches 7 and 8 on the remote module, the switches determine the number of I/O words the remote module sends to the base module (see table below).

I/O Words per remote	Switch 7	Switch 8
32	Off	Off
16	Off	On
10	On	Off
8	On	On

These words are distributed from the remotes into the 32 words of the base module.

NOTE:
ANY DATA ALLOCATED TO THE OUTPUT IMAGE TABLE IS "SENT" TO THE INPUT IMAGE TABLE OF THE OTHER CORRESPONDING MODULE.

Configuring One Remote

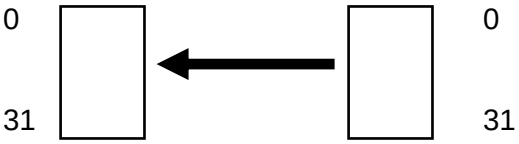
All 32 words from the remote are directly mapped to the base in a point-to-point setup (base and one remote).

In a network with a base and only one remote, the address DIP switch on the base (SW1) must be set to a value other than all on or all off. The address DIP switch (SW1) on the remote must be set identical to that of the base.

Below you will find a graphical representation of the movement of data between SLC processors.

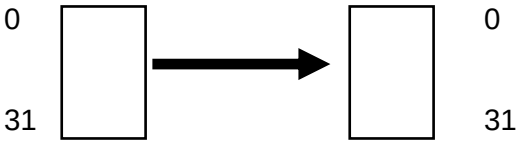
Remote to base communication

Base Module Input Image Table — Remote Module Output Image Table



Base to remote communication

Base Module Output Image Table — Remote Module Input Image Table

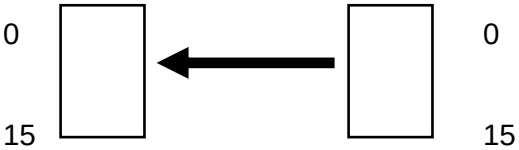


Configuring Two Remotes

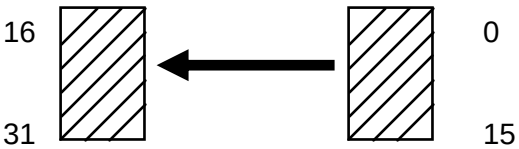
With a network comprising of a base and two remotes, each remote communicates 16 words into and out of the base. The base address switch will be set to address 0 (all off), remote #1 will be set at address one, remote #2 will be set at address two. This mapping is represented in the following diagrams.

Remotes to base communication

Base Module Input Image Table — Remote Module #1 Output Image Table

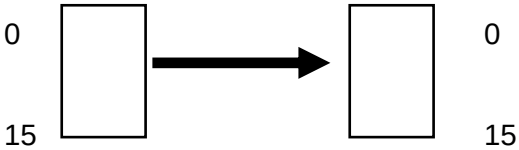


Base Module Input Image Table — Remote Module #2 Output Image Table

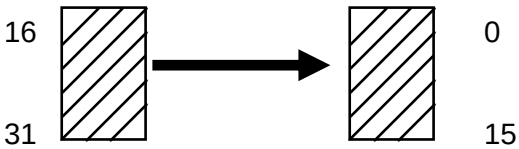


Base to remotes communication

Base Module Output Image Table — Remote Module #1 Input Image Table



Base Module Output Image Table — Remote Module #2 Input Image Table

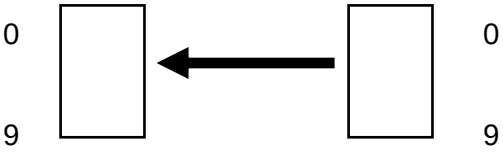


Configuring Three Remotes

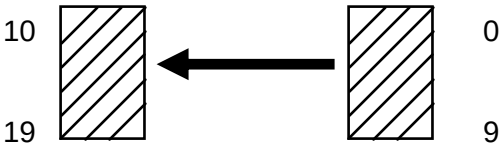
With a network comprising of a base and three remotes, each remote communicates 10 words into and out of the base. The base address switch will be set to address 0 (all off), remote #1 will be set at address one, remote #2 will be set at address two, and remote #3 will be set at address three. This mapping is represented in the following diagrams.

Remotes to base communication

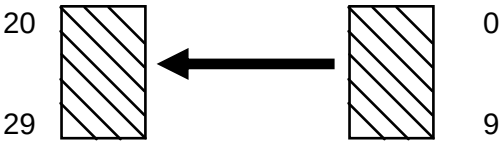
Base Module Input Image Table — Remote Module #1 Output Image Table



Base Module Input Image Table — Remote Module #2 Output Image Table

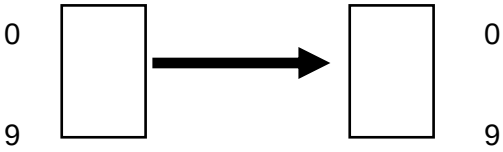


Base Module Input Image Table — Remote Module #3 Output Image Table

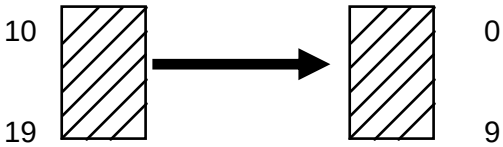


Base to remotes communication

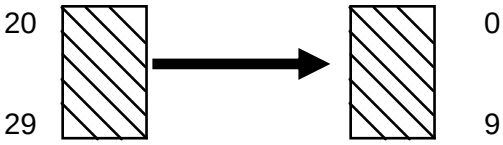
Base Module Output Image Table — Remote Module #1 Input Image Table



Base Module Output Image Table — Remote Module #2 Input Image Table



Base Module Output Image Table — Remote Module #3 Input Image Table



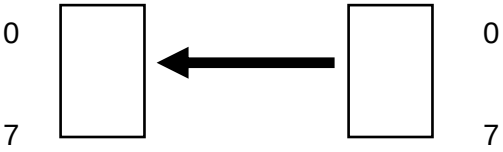
NOTE: Words 30 and 31 in the base data tables are not used with three remotes.

Configuring Four Remotes

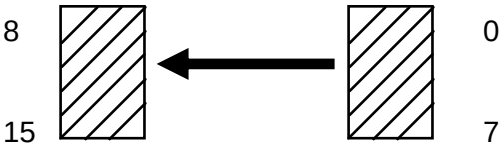
With a network comprising of a base and four remotes, each remote communicates 8 words into and out of the base. The base address switch will be set to address 0 (all off), remote #1 will be set at address one, remote #2 will be set at address two, remote #3 will be set at address three, and remote #4 will be set at address four. This mapping is represented in the following diagrams.

Remotes to base communication

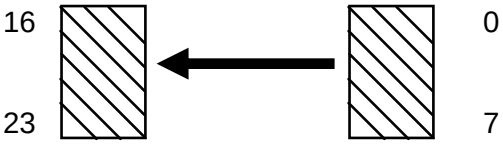
Base Module Input Image Table / Remote Module #1 Output Image Table



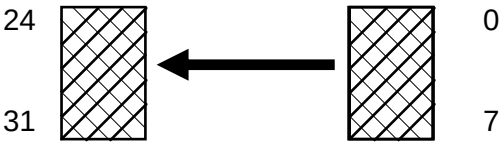
Base Module Input Image Table / Remote Module #2 Output Image Table



Base Module Input Image Table / Remote Module #3 Output Image Table

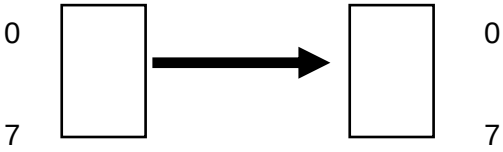


Base Module Input Image Table / Remote Module #4 Output Image Table

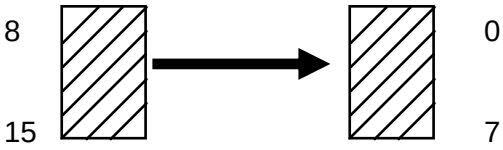


Base to remotes communication

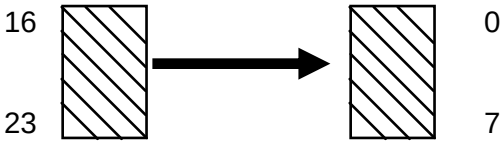
Base Module Output Image Table / Remote Module #1 Input Image Table



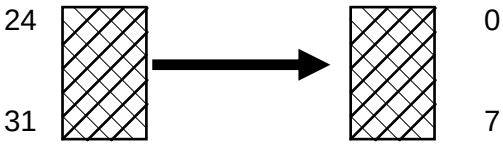
Base Module Output Image Table / Remote Module #2 Input Image Table



Base Module Output Image Table / Remote Module #3 Input Image Table



Base Module Output Image Table / Remote Module #4 Input Image Table



Appendix A G-File Structure

	Bits															
Words	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
0	Reserved															
1	System ID Always Hex A55A															
2	Base Address															
3	Reserved															
4	Station Address															
5	Dip Switch Disable															
6	Network Address															
7	Number of Remotes Using Scanned I/O															
8	Number of Scanned I/O Words								Address of Remote #1							
9	Number of Scanned I/O Words								Address of Remote #2							
10	Number of Scanned I/O Words								Address of Remote #3							
11	Number of Scanned I/O Words								Address of Remote #4							
12	Number of Scanned I/O Words								Address of Remote #5							
13	Number of Scanned I/O Words								Address of Remote #6							
14	Number of Scanned I/O Words								Address of Remote #7							
15	Number of Scanned I/O Words								Address of Remote #8							
16	Number of Scanned I/O Words								Address of Remote #9							
17	Number of Scanned I/O Words								Address of Remote #10							
18	Number of Scanned I/O Words								Address of Remote #11							
19	Number of Scanned I/O Words								Address of Remote #12							
20	Number of Scanned I/O Words								Address of Remote #13							
21	Number of Scanned I/O Words								Address of Remote #14							
22	Number of Scanned I/O Words								Address of Remote #15							
23	Number of Scanned I/O Words								Address of Remote #16							
24	30 msec<Output scan time (msec)<1280 msec															
25	30 msec < Input scan time-out (msec) < 1280 msec															
26	Reserved															
27	Reserved															
28	Reserved															
29	Number of words base sends								FFh							
30	Number of remotes in network															
31	Transmit Power															

For a module configured by the DIP switches, only word 1 must be filled in. All other words must be set to zero.

WORD 2 When bit 15 of word-2 is "1" (8000h), bits 0-7 indicate the address of the base module in the network, and over-ride the DIP switch setting. In a point-to-point network, valid values are 8001h to 80FEh. In a multi-remote network, the value must be 80FFh. This word must be the same for every module in the network.

WORD 4 When bit 15 of word-4 is "1" (8000h):

- For remote modules, bits 0-7 indicate this module's address in the network, and over-ride the DIP switch setting. Valid values are 8001h to 80FEh. This word must be different for every remote module in the network.
- For base modules these bits should be set to zero.

WORD 5 When bit 15 of word-5 is "1" (8000h):

- This indicates that the G-file settings will override the DIP switch settings in configuring the parameters for the network. This requires G-file words 2, 4, 6-23, 29, 30 and 31 to be set up for proper operation.
- The G-file cannot override these three DIP switches: CPU/01, NORM/DIAG or REM/BASE.

WORD 6 Bits 0-7 of word-6 set the network number. Valid values are 0h to 3Fh.

For reference, this table shows the correlation between DIP switch settings and G-file values.

Word6 value	DIP 5	DIP 6
8h	off	off
9h	off	ON
Ah	ON	off
Bh	ON	ON

- This word must be the same for every module in the network.
- This word is only used if word-5 bit 15 is "1", otherwise the two NET DIP switches are used.

Word 7 This is the number of modules to talk to.

- For base modules, this is the number of remotes in the network.
- For remotes, this is 1h (because they only talk to the base).

This word is only used if word-5 bit 15 is "1". Otherwise the two CFG DIP switches are used.

Words 8 – 23 The upper byte of each word (8-23) establishes number of scanned I/O words transmitted to and received by each remote. The lower byte holds the address of that remote. The same list (words 8-23) must be in the base and all remotes in a network. All unused words should contain zeros. There can be no gaps; use consecutive words in this section and place zeroes in remainder of words through word 23.

These words are only used if word-5 bit 15 is "1".

Word 29 The high byte is the number of words the base sends. This should equal the sum of the number of scanned I/O words for all the remotes.

The low byte is FFh.

This word is only used if word-5 bit 15 is "1", and must be the same for every module in the network.

Word 30 This is the number of remotes in the network. Valid values are 1h to 10h.

This word is only used if word-5 bit 15 is "1", and must be the same for every module in the network.

Word 31 Set to zero for 100 mW, or non-zero for 10 mW.

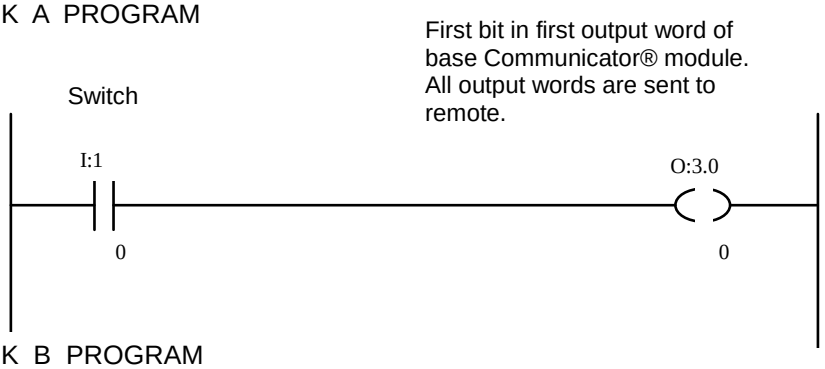
Appendix B Programming Examples

Discrete programming

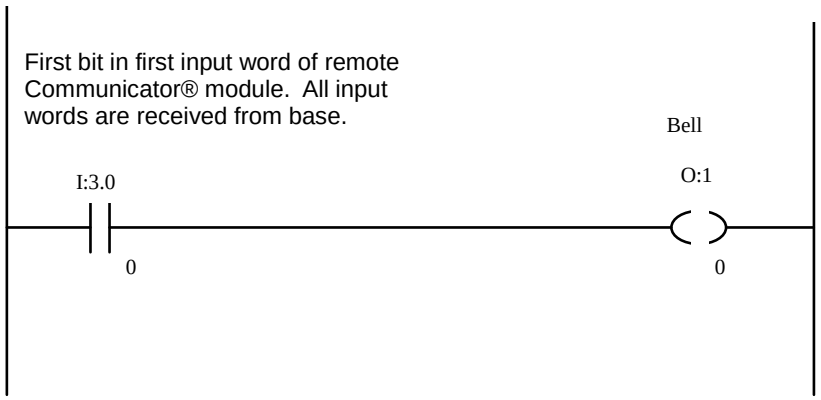
In the following example, the base Communicator® module is located in rack “A” slot 3 and the remote Communicator® module is located in rack “B” slot 3. Rack “A" also has an input module in slot 1 and rack “B” contains an output module in slot 1.

The objective will be to initiate a command by turning on a switch wired to rack “A” input module, pass the bit through the wireless link provided by the Communicator® base to the Communicator® remote, and energize a bell wired to rack “B” output module.

RACK A PROGRAM



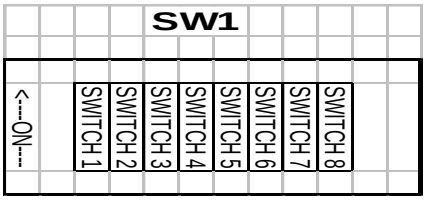
RACK B PROGRAM



Appendix C DIP Switch Settings

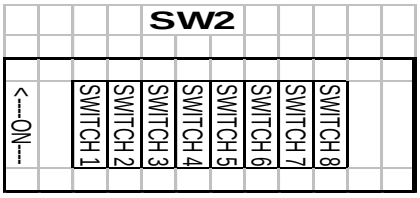
Located on the front of the Communicator® module are two banks of DIP switches. Each bank consists of eight switches. These switches are labeled as SW1 and SW2 and there settings are as follows:

SW1 Module Address DIP Switch



All remotes must have unique address

SW2 Module Configuration DIP Switch



Switch 1 – Selects 5/01 CPU or 5/02 CPU and larger
Switch 2 – Diagnostic switch (must be in norm position)
Switch 3 – Selects module as remote or base
Switch 4 – Selects high or low power output for radio
Switch 5,6 –

Allows for selection of up to 4 separate network addresses. All remotes that will connect with that base must have switches 5 and 6 set the same as the base.

Switch 7,8 –

7 and 8 off – one base, one remote
7 off 8 on – one base, two remotes
7 on 8 off – one base, three remotes
7 and 8 on – one base, four remotes

Appendix D I/O Configuration Table

X – DENOTES SWITCH CAN BE IN EITHER POSITION

Product ID	CPU/01	NORM/DIAG	REM/BASE	HPWR/LPWR	NET	NET	CFG	CFG	NUMBER OF WORDS INPUT/OUTPUT
SWITCH NUMBER	1	2	3	4	5	6	7	8	
3535	/01 ON	NORM OFF	X	X	X	X	OFF	OFF	8/8
13135	CPU OFF	NORM OFF	REM OFF	X	X	X	ON	ON	8/8
13235	CPU OFF	NORM OFF	REM OFF	X	X	X	ON	OFF	10/10
13435	CPU OFF	NORM OFF	REM OFF	X	X	X	OFF	ON	16/16
				X	X	X	OFF	OFF	32/32
				X	X	X	X	X	32/32

Appendix E 2.4GHz Antenna Installation Guide

SCOPE: To aid in the installation and maintenance of Control Chief's 2.4GHz Communicator® module. Control Chief P/N's 1746cccIWCM2410 and 90-20-0-026.

PREFACE: All equipment should be installed by qualified personnel and in compliance with the National Electrical Code (NEC), local, state and federal ordinances.

ANTENNA PLACEMENT: For best results, the following should be achieved:

a) There should be a clear, unobstructed line of site between the antennas. 2.4GHz propagation does not travel around or through obstructions very well.
b) The antennas should be on the same elevation, and should be plumb.
c) The antennas should be mounted approximately 24 inches away from the nearest vertical metallic object.
d) To comply with FCC mandated RF exposure limits, gain antennas of 6dB and higher need to be installed in such a way that the general public will not be closer than 18 inches from the radiating aperture.

ANTENNA CABLING: For best results, the following should be achieved:

a) Avoid routing antenna cabling along with power and/or control wiring or any sources of electrical noise.
b) Keep antenna cabling as short and direct as possible. Cable losses are substantial at 2.4GHz.
c) Do not coil up excess cabling. If required, consult Control Chief to obtain custom length cables.
d) Always strain relieve and secure the cabling in several places to minimize any cabling movement. Using UV rated cable ties, secure the cable 6-8" from the antenna.
e) Avoid kinks and sharp bends of the antenna cabling. The RG8 cable has a 0.4 in diameter and a minimum bend radius of 4 inches. The attached connectors have a 0.80 inch diameter.
f) Seal and weatherproof all outside or environmentally demanding coaxial connections.

GROUNDING: For best results, the following should be achieved:

a) Refer to Allen Bradley's "INDUSTRIAL AUTOMATION WIRING AND GROUNDING GUIDELINES" Publication at: http://www.ab.com/manuals/gi/1770-in041a-en-p.pdf .
b) Whenever connecting a ground, use star type washers and remove any local paint or other insulators.
c) Do not sandwich more than one ground lug on top of another without separating with a star washer.
d) Always use a single point ground bus for ground connections.
e) Always securely attach the coaxial bulkhead connector to the grounded enclosure.

ADDITIONAL OPTIONS: The following options can be ordered to achieve extended ranges and/or better antenna placements. These antenna systems need to be installed and aligned by qualified personal. The higher the gain of the antenna, the more directional it becomes, which could lead to a more difficult installation and alignment. Please consult Control Chief with application specific questions. 1-814-362-6811.

RECOMMENDED ANTENNAS:

P/N 28-04-0-016 2.4GHz 6dB Omni
P/N 28-04-0-012 2.4GHz 9dB Omni
P/N 28-04-0-019 2.4GHz 9dB Corner Reflector
P/N 28-04-0-010 2.4GHz 14dB Corner Reflector
P/N 28-04-0-009 2.4GHz 15dB Yagi
P/N 28-04-0-008 2.4GHz 24dB Parabolic Dish

To use one of the above antennas, each of the following cable assemblies must be utilized.

P/N 91-03-0-032 3 foot Reverse Polarity SMA / N female cable assembly
P/N 91-03-0-030-CE N male / N male RG8 cable assembly (Specify length, in feet, at time of order. Applications requiring over 50 feet of cable should be reviewed by Control Chief.)

If the antenna is mounted outside, it is recommended to have some lightning protection.

P/N 28-04-5-001 Lightning Arrestor, N male / N female

Note: Control Chief cannot be held responsible for damage due to lighting strikes which may have caused damage to Control Chief's equipment or any other equipment which may be connected to it.

TYPICAL EXTERNAL ANTENNA INSTALLATION:

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