

Application Note



2500 Series® Programmable Automation Control System

Understanding CIDR Notation Used for IP Address Display on 2500 Series® Processors

Newer CTI products featuring Ethernet ports, such as the 2500 Series® processor, the 2500P-ECC1, and 2500P-ACP1, display the IP address of the product on the front panel multi-segment display. This information has proven very useful to most customers, facilitating the connection of browsers to obtain diagnostic data and providing visual confirmation of the operating IP address.

Beginning with Version 8.02 of the 2500 Series® processor firmware, we've added the capability to display the subnet mask in CIDR notation. This gives users more complete information about the IP address setting to allow them to easily get connected. This application note shows how to interpret the CIDR notation displayed on the front of the processor.



What is CIDR Notation?

CIDR notation (Classless Inter-Domain Routing) is an alternate method of representing a subnet mask. It is simply a count of the number of network bits (bits that are set to 1) in the subnet mask. Subnet mask bits are explained in a following section.

The CIDR number is typically preceded by a slash "/" and follows the IP address. For example, an IP address of 131.10.55.70 with a subnet mask of 255.0.0.0 (which has 8 network bits) would be represented as 131.10.55.70 /8.

CIDR notation is more concise method for designating the subnet mask. Compared to Dotted Decimal notation, which represents the mask as four values, each representing the decimal value of an octet of the mask, the CIDR format represents the mask as a single value. Because of this characteristic, CIDR is a better format for display on the multi-segment display, which can display only three characters at a time. It can be presented in one display period following the IP address.

NOTE: The CTI 2500 Series products that display the subnet mask on a Multi-Segment Display precede the CIDR number with an underline "_" instead of a slash "/" because a slash is easily confused with the digit "1".

Why is the Subnet Mask Important?

In order to communicate with directly with a device that is on the same Ethernet network segment as your PC, you must know the IP address *and* the subnet mask of the device. For example, if you are trying to access the Web server of a 2500 Series product to set its IP parameters, your PC must use the same subnet mask as the 2500 Series product and it must use an IP address that is on the same subnet.

How is a Subnet Mask Used?

The Subnet Mask is used to determine how an IP (Internet Protocol) message sent by an IP host (such as your PC) will be routed. If the destination IP address of the message is on the same subnet as the IP address of the transmitting IP host, the message will be sent directly to the Ethernet MAC address of the destination device. If the subnets are different, the message will be sent to the Ethernet MAC address of the default gateway/router. If a default gateway/router is not specified or the specified gateway/router is not accessible or the message cannot be routed, the message is discarded.

How is an IP Subnet Determined?

An IP address is a 32 bit number that conveys two pieces of information, the Network Identifier (Network ID) and the Host Identifier (Host ID). The Network ID designates the IP subnet address; the Host ID designates a specific host (device) address. In the subnet mask, bits that are set to 1 designate the Network ID. These bits start in the most significant bit (MSB) position and are contiguous. The following bits, which are set to 0, represent the Host ID. See the following example.

This example assumes an IP Address of 128.54.177.97 and a subnet mask of 255.255.255.0.

	Dotted Decimal Notation	Binary Format
IP Address	128.54.177.97	10000000 00110110 01001101 01100001
Subnet Mask	255.255.255.0	11111111 11111111 11111111 00000000
Subnet Address	128.54.177.0	10000000 00110110 01001101 00000000
Host Address	0.0.0.97	00000000 00000000 00000000 01100001



The network address is obtained by performing a bitwise AND comparison between the IP address and the subnet mask. A bitwise AND compares each bit in the IP address with the corresponding bit in the subnet mask. If both bits are 1, the corresponding subnet address bit will be a 1. Else the corresponding subnet bit will be 0. Bits that are set to 1 identify the subnet and bits that are set to 0 identify the host. In this example, the subnet address is 128.54.177 and the host ID is .97. To communicate directly with this device, your PC IP address must be 128.54.177.n, where n is a number ranging from 1-254 (except 97, which would be a duplicate of the destination device IP Host ID).

How do I Convert between CIDR and Dotted Decimal Notation?

The easiest method is to use the following table to convert between CIDR and Dotted Decimal notation.

CIDR	Dotted Decimal		CIDR	Dotted Decimal
/1	128.0.0.0*		/17	255.255.128.0
/2	192.0.0.0*		/18	255.255.192.0
/3	224.0.0.0		/19	255.255.224.0
/4	240.0.0.0		/20	255.255.240.0
/5	248.0.0.0		/21	255.255.248.0
/6	252.0.0.0		/22	255.255.252.0
/7	254.0.0.0		/23	255.255.254.0
/8	255.0.0.0		/24	255.255.255.0
/9	255.128.0.0		/25	255.255.255.128
/10	255.192.0.0		/26	255.255.255.192
/11	255.224.0.0		/27	255.255.255.224
/12	255.240.0.0		/28	255.255.255.240
/13	255.248.0.0		/29	255.255.255.248
/14	255.252.0.0		/30	255.255.255.252
/15	255.254.0.0		/31	255.255.255.254*
/16	255.255.0.0		/32	255.255.255.255*

* Not allowed for CTI products

Alternately, you can use a calculator, such as the Windows calculator (Programmer View), to convert the binary value of the last non-zero octet to a decimal value. For example: a CIDR of 20 will have 16 bits in the first two octets represented as 255.255. The third octet has the remaining four network bits in the most significant bit positions (11110000 binary = 240 decimal). Thus the dotted decimal equivalent is 255.255.240.0.

