Setting the IP Address Using the PLC
For 2572-A and 2572-B Products

SUMMARY

This is a companion Tech Tip to *Setting the IP Address on CTI Products.* It details how to set the IP Address and other network parameters using the PLC Program for two CTI products:

- 2572-A
- 2572-B

Think of this Tech Tip as a "Quick Start" for setting 2572-A and 2572-B network parameters using the PLC. More detailed instructions can also be found in the respective user manuals for each of the products.

Before You Get Started

As you may have read in the Tech Tip on *Setting the IP Address on CTI Products*, there are two options for setting the IP Address for the 2572-A and 2572-B: you may set the network parameters manually, or you may set the network parameters using the PLC program. This Tech Tip is exclusively about using the PLC to set the network parameters for your 2572-A or 2572-B.

PLC START

Using PLC logic to set the network parameters ensures that the IP address is directly associated with the PLC and not the module. This is very helpful if you need to replace the module as the new module will automatically have the correct IP address, and the old module, if moved elsewhere, will not cause issues due to having the "wrong" network address.

In order to use the PLC program to set network parameters for your module, you must run your module in PLC START mode. SW4 must be in the Open position.
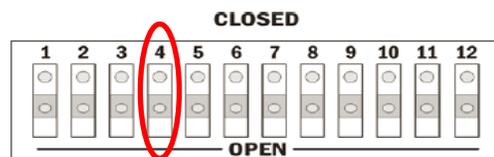
In the PLC START position, the module will wait for the Start Network Services command before starting the network services. This command is what sets the IP Address and other network parameters for the module. You will learn how to set up and execute the Start Network Services command block in the following sections.

Setting the IP Address from the PLC Program

The next few sections will walk you through the following steps:

1) Log in the Module to the I/O Configuration
2) Gain an Understanding of Command Blocks and the PLC Command Interface
3) Create a *Start Network Services* Command Block
4) Write the Ladder Logic to execute the Command Block

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*Please note that when using the PLC START option, the PLC must be in RUN mode before the module will start

1. Log in the Module to the I/O Configuration

In order to use the PLC to set network parameters for your 2572-A or 2572-B module, you will need to enter the module into the PLC I/O configuration using your PLC programming application. Both the 2572-A and the 2572-B log in as Special Function modules using two WX words and six WY words. In the example to the right, the module is installed into slot 1 on I/O base 0 (local base) and will be logged in starting at address 1.

After the PLC reads the I/O base, if the number of WX and WY words are the same as those shown in the example and Special function = Yes, then the PLC can recognize the module. Change the address as required by your application and save the result. If the line is blank or erroneous, re-check the module to ensure that it is firmly seated in the I/O base slot. Generate the PLC I/O configuration chart again by reading the I/O base. If the problem persists, contact your distributor or CTI customer support.

2. Gain an Understanding of the PLC Command Interface and Command Blocks

As described above, the 2572-A and 2572-B log in as Special Function modules using two WX and six WY words. PLC logic uses the WY words to control module operation and the WX words to monitor module operation. The Command Blocks are contained in WY5—WY8 (also depicted in the following illustration).

The Module Status Word (WX1) contains bits that allow the PLC to monitor the operation of the module. The Command Status Word (WX2) contains bits that allow the
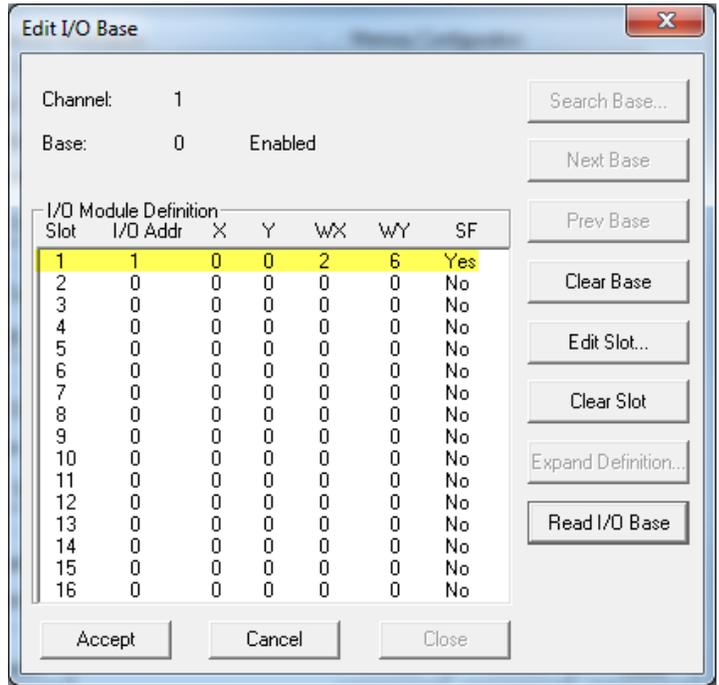

Figure 1: Logging the Module into the I/O Configuration

PLC to monitor execution of commands. The Module Control Word (WY3) contains bits that allow the PLC to control module global operation. The Command Control Word (WY4) contains bits that allow the PLC to initiate commands and clear errors. And WY5—WY8 contain the starting V Memory addresses of up to four Command Blocks that will be described in more detail below. One of these will be the Start Network Server Command Block that will set the IP address for the module.
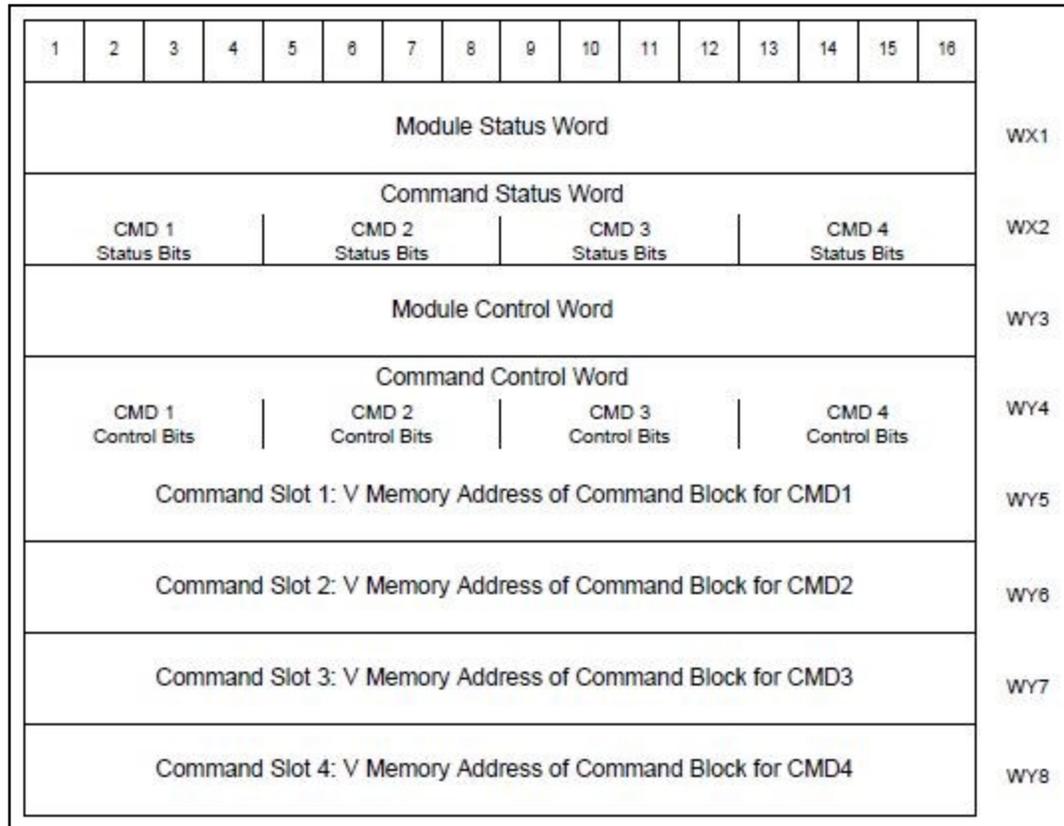

Figure 2: WX/WY Map

Command Blocks

Command Blocks specify the command to be executed along with parameters that define the execution. A command block consists of up to 15 contiguous words of V memory, as illustrated below in Figure 3. The first three words are common to all command blocks. The remaining words contain command parameters which vary with each command.

Offset	Contents	Description
0	Command Error Word	When an error occurs, the module will write an error code to this offset. User logic should clear this error code (set it to 0) after a successful attempt.
1	Command	The command code specifies the function to be performed.
2	Connection Number (19291 - 19299)	The connection number is used by the 2572-B module to identify a command instance. Connection numbers must be unique and be within the range allowed by the command.
3 -15	Command Parameters	Values that specify how the command will be executed.

Figure 3: Command Block Illustration

Please note that when command blocks are specified, a **bold** entry indicates a required value. An entry that is not bold represents a *recommended* value that you should use unless you have reason to do otherwise. A blank entry indicates that you are free to choose any allowable value. Values for the command block entry shown below are in both hexadecimal and decimal (integer) format. Using your PLC programming software, you can configure a chart to display the values in either format desired.

3. Create a Start Network Services Command Block

To set up your Start Network Services Command Block in V memory using your PLC programming software, you may use the example below as your starting point. As noted above, **bold** entries are required values (also circled in red).

Offset	Description	Hex Value	Decimal Value
0	Command Error Word	**0000**	**0**
1	Command (Start Network Server)	**0004**	**4**
2	Connection Number (19291 – 19299)	4B62	19298
3	Protocol Manager Number	**0023**	**35**
4	*Unused in 2572-A and 2572-B*	0000	0
5	TCP Keep Alive Interval in Seconds (0=default=60) (Set to 65000 or greater to disable Keep Alive) *(Unused in 2572-B)*	0000	0
6	IP Address of this Module (High 16 bits)		
7	IP Address of this Module (Low 16 bits)		
8	TCP/UDP Port Number	05E1	1505
9	IP Address of Default Router (High 16 bits)		
10	IP Address of Default Router (Low 16 bits)		
11	Max Number of TCP Connections (0=default) *(Unused in 2572-B)*	0000	0
12	Subnet Mask (High 16 bits)		
13	Subnet Mask (Low 16 bits)		
14	IP Multicast Receive Address (High 16 bits) If you do not want to receive multicast, set this value to 0	0000	0
15	IP Multicast Receive Address (Low 16 bits) If you do not want to receive multicast, set this value to 0	0000	0

Figure 4: Start Network Services Command Block Example

Offset 0   *Error Word* — Set to 0 so that any previous error code is cleared

Offset 1   *Command Code* — The Command for Start Network Services is 4.

Offset 2   *Connection Number* — you should set this number in the range of 19291 to 19299 to prevent inadvertent conflict with any client connections you may create. The value of 19298 is used in CTI examples.

Offset 3   *Protocol Manager Number* — Protocol Managers control the operation of the serial and network ports. Protocol Manager 35 (23 hex) selects the PLC Network Server.

Offset 4   *Unused* — This word is not used for either the 2572-A or the 2572-B.

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Offset 5   *TCP Keep Alive Interval/Unused* — For the 2572-B, this word is not used. For the 2572-A, this value specifies the amount of elapsed time (in seconds) without any messages from the client application before the 2572-A will automatically close a server TCP socket. If the value is set to 0, then the 2572-A will use the default value of 60 seconds. To disable Keep Alive, set the value to 65,000 or greater.

Offset 6-7   *IP Address* — Offset 6 should contain the high 16 bits of the module IP Address. Offset 7 should contain the low 16 bits of the IP Address. An IP Address of 0.0.0.0 (0000 0000 hex) or greater than 223.255.255.255 (DFFF FFFF hex) will return an error.

Offset 8   *TCP/UDP Port* — This will be the port number used to connect to the 2572-A or 2572-B PLC Server application. The examples in this Tech Tip assume that this will be set to 1505 decimal. You should use this value unless you have a reason to do otherwise. A port number of 0 is invalid.

Offset 9-10   *IP Address of Default Router* — This identifies the address of the gateway to which a packet with a destination IP address that is not on this module's IP subnet will be sent. Offset 9 contains the high 16 bits of the address and Offset 10 contains the low 16 bits. An address greater than 223.255.255.255 (DFFF FFFF hex) will return an error. If you do not have a gateway/router on your network, set this to 0.0.0.0 (0000 0000 hex).

Offset 11   *Maximum Number of TCP Connections/Unused* — For the 2572-B, this word is not used. For the 2572-A, this value specifies the maximum number of concurrent TCP connections to the PLC server that will be allowed. Once the maximum number has been attained, the 2572-A will reject further attempts to connect until a connection is relinquished. Once a connection is properly closed, the slot is available for another connection. If you set the value in this word to 0, then the 2572-A will use the default module value of 16. You may set this to a number less than 16 to limit access or increase the number up to 24 to allow more connections.

Offset 12-13   *Subnet Mask* — Specifies the subnet mask assigned to this network. Offset 12 contains the high 16 bits of the mask and Offset 13 contains the low 16 bits. If Offset 12 and 13 contain a value of 0, then the subnet mask will default to the standard for the IP address class (see Appendix B). A subnet mask must contain all 1's in the network portion of the IP address and must allow at least 2 bits of host address. In addition, the subnet mask cannot be set so that the derived host address is 0 or a broadcast address (all bits set to 1).

Offset 14-15   *IP Multicast Receive Address* — If you want the module to receive multicast data, enter the multicast address that you want the module to listen to. The valid range of multicast addresses is 224.0.0.34 through 239.255.255.255. If you do not want to listen to a multicast address, set these words to a value of 0.

When choosing the various IP addresses and subnet mask, set up your PLC programming software to display the words in hexadecimal. You will then be able to enter each byte of the dotted notation individually. For example, if the IP address were 198.35.34.10, you could enter the first word as hex C623 where the high byte (C6) is the hex equivalent of decimal 198 and the low byte (23) is the hex equivalent of decimal 35. Similarly, you would enter the second word as hex 220A. See the following illustration.
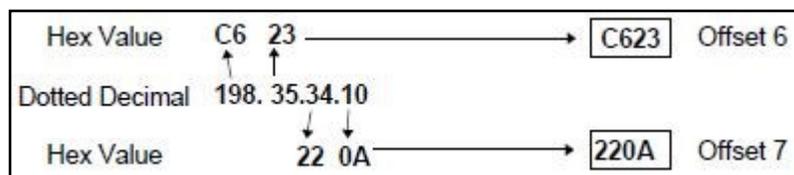

Figure 5: Representing IP Address in Hexadecimal Format

Now that you've written the Start Network Services Command Block in your programming software, you will need to write the logic for your PLC that will execute the command block. Your ladder logic will:

• Load a command slot with the address of your Start Network Services command block

• Set the applicable command trigger and mode bits in WY4

• Monitor the status of the command processing using WX2

4. Write the Ladder Logic to Execute the Command Block

Net Configuration Status Word Signals Command Block Execution

The *Start Network Services* command block will be executed only when the *Network Configuration Required* bit (NET CFG in WX1) is set to 1. The NET CGF bit is set by the module application code, and the primary use of this bit is to condition PLC ladder logic to trigger the *Start Network Services* command. The module software will automatically set the value of this bit to 1 at startup when the PLC START option has been selected. When the CAMP network server has successfully started (after the *Start Network Services* block is executed and network parameters are successfully set), this bit is then set to a value of 0. While the module is waiting on PLC logic to trigger the *Start Network Services* command, the *Network Status* (NS) LED will flash. Please note that if you trigger the *Start Network Services* command while the command block contains invalid data, the module will return an error code and then halt. To recover, you must correct the command block entry and reset the module. Please note also that the NET CFG bit will be reset to 1 (thus triggering the *Start Network Services* command block again) if the module is reset for any reason.

Ladder Logic Example

The following diagram illustrates the ladder logic that executes the *Start Network Services* command block. This example assumes that the command block is located in V memory starting at V500 and that command slot 1 is used for the command. As you will see, it loads the command slot with the address of the command block in Rung 1. It sets the applicable command trigger and mode bits in WY4 and monitors the status of the command processing using WY2 in Rung 2.
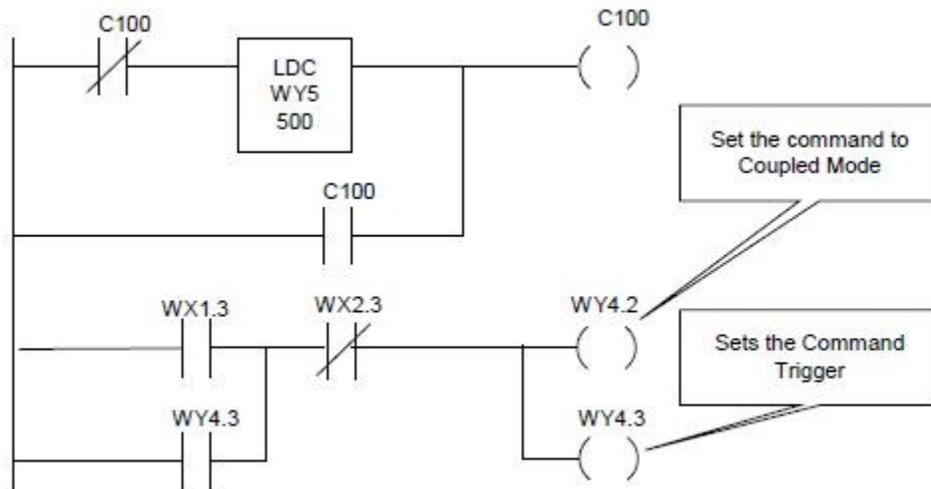

Figure 6: Ladder Logic Illustration

- Rung 1 loads the location of the Command Block (V500) into Command Slot 1 (WY5). Once the control relay is on, it seals off the command. The load command will be bypassed on subsequent scans.

- Rung 2 sets the Command Trigger (WY4.3) and Command Mode (WY4.2) when the NET CFG bit (WX1.3) is on and the Command Busy bit (WX2.3) is off. When the logic sees the 2572-A or 2572-B raise Command Busy (WX2.3), it lowers the Command Mode (WY4.2) and Command Trigger (WY4.3), completing the coupled mode cycle. It is important that you use coupled mode for this command block. Coupled mode means that you will execute this command once. Uncoupled mode will execute the command continuously as long as the trigger is held high. Uncoupled mode could be used for memory transfer commands.

- The NET CGF bit will be raised by the 2572-A or 2572-B at any time that the network configuration parameters are not set. Therefore, this logic will re-execute the *Start Network Services* command if the 2572-A or 2572-B is restarted for any reason.

Please note: Do not use retentive relays in this logic. Proper operation of this logic depends on the control relay transitioning from off to on when power is cycled.

If you need additional help, please see the User Manuals for either the 2572-A or the 2572-B (*Installation and Operation Guide*, *Chapter 4* and *Appendix C* for the 2572-A; and *Installation and Operation Guide*, *Chapter 8* and *Appendix B* for the 2572-B). Both manuals include much more information on the PLC command interface, programming command blocks, command timing, including coupled and uncoupled modes, command processing, and other considerations.

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APPENDIX A: CTI Ethernet Products IP Addressing Reference Chart

| | Features | | | | | | Configurable from: | | | |
	Ships w/default IP address assigned	Default IP Address	Default subnet mask address	Displays IP Address	CPU must have same network and subnet mask address	Supports multicast address	PLC Program	ini file on SD card	Webserver	Other
2572-A	yes	169.254.1.1	255.255.0.0	no	no	yes	yes	no	yes	CTIDIAG
2572-B	yes	169.254.1.1	255.255.0.0	yes	no	yes	yes	no	yes	
ECC1	no	n/a	n/a	yes	yes	yes	no	no	no	ECC1 Configuration Program
ACP1	no	n/a	n/a	yes	depends**	yes	no	yes	yes	
2500-Cxxx	no*	n/a	n/a	yes	n/a	no	no	no	yes	CPU_IPSET

* CTI 2500-Cxxx CPUs ship with no network parameters. When you connect the Ethernet port to a switch or PC, the controller will automatically generate a temporary Link Local IP address. ** If using data cache or CAMP client for ACP1 to communicate to CPU, both CPU and ACP1 must have same network and subnet mask addresses.

APPENDIX B: IP Addressing

Every host interface on a TCP/IP network is identified by a unique IP address. This address is used to uniquely identify the host device, such as a workstation or communications module, and the network to which the host belongs. Each IP address consists of 32 bits, divided into four 8 bit entities called octets. These octets are divided into a network portion of the address and a host portion with the help of a subnet mask (more on this below). An IP address is expressed in dotted notation, with each octet expressed as its decimal equivalent. The value in each octet ranges from 0 to 255 decimal or 00000000—11111111 binary. See the example below.

Notation	Octet 1	Octet 2	Octet 3	Octet 4
Binary	11000000	11011111	10110001	00000001
Decimal	192	223	177	1

Address Classes

IP Addresses are broken into different classes in order to accommodate networks of varying sizes. The network class can be discerned from the first octet of its IP address. The following table lists the three most common IP address classes along with the default subnet mask for each class and the total number of Network IDs and Host IDs for each address class. It also indicates which portion of its address is for network versus the portion used by network managers to divide into subnets and hosts.

Class	First Octet Value*	Default Subnet Mask	Network portion	Subnet/host portion	Number of networks	Number of hosts per network
A	1-126	255.0.0.0	First Octet	Last 3 Octets	126	16,777,214
B	128-191	255.255.0.0	First 2 Octets	Last 2 Octets	16,384	65,534
C	192-223	255.255.255.0	First 3 Octets	Last Octet	2,097,151	254

* Address 127 is reserved for loopback testing and inter-process communication on the local computer; it is not a valid network address. Addresses 224 – 239 are used for Class D (IP multicast). Class E (240 - 255) are reserved for future use.

Subnet Mask

Used alone, the designation of network classes is very inflexible. For example, a Class A network assigns a large number of host devices to the same IP network; potentially reducing performance, limiting topology, and compromising network security. An additional entity, the Subnet Mask, provides means of dividing a large IP network into a collection of smaller networks called subnets.

The Subnet Mask is a collection of 32 bits that distinguish the network ID portion of the IP address from the host ID. Like the IP Address, the resulting 32-bit value is expressed in dotted decimal notation. In binary form, however, it is easy to identify the network and host IDs: any bits which have corresponding mask bits set to 1 represent the network, and any address bits that have corresponding mask bits set to 0 represent the host ID. Or in decimal form, the octets of the IP address where the corresponding octet of the subnet mask is 255 belong to the Network ID and the octets of the IP address where the corresponding octet of the subnet mask is 0 belong to the Host ID.

Bits for Network Mask				Network Mask in Dotted Decimal
11111111	00000000	00000000	00000000	255.0.0.0 (default class A subnet mask)
11111111	11111111	00000000	00000000	255.255.0.0 (default class B subnet mask)
11111111	11111111	11110000	00000000	255.255.240.0 (subnetted class B network)
11111111	11111111	11111111	00000000	255.255.255.0 (default class C subnet mask)

For example: when the IP address is 172.54.177.97 and the subnet mask is 255.255.255.0, the Network ID is 172.54.177 and the Host ID is 97. If your subnet mask does not align with octet boundaries (for instance, 255.255.240.0), you will need to consult one of our user manuals for help in performing a bitwise "and" calculation (see the User Manual for the 2500P-ECC1) in order to determine the network and host IDs.

Final Reminder

When you are configuring the IP address of devices that must communicate on a local network, you must ensure that:

• The Subnet Mask of all devices are the same,
• The Network ID of all hosts are the same,
• The Host ID of each host is different.

APPENDIX C: Using the Product Display to Determine the IP Address and Subnet Mask

CTI products with front panel displays (2500-Cxxx processors, 2572-B, 2500P-ECC1, 2500P-ACP1) running recent firmware versions display the IP address in dotted decimal format followed by the subnet mask in CIDR format. The CIDR format is an alternate, more recent means of specifying the mask which simply designates the number of network ID bits.

See the conversion table to the right.

For Additional Help

Please do not hesitate to contact us if we can be of further assistance. You can reach our technical support line at +1.865.584.0440 or email us at support@controltechnology.com. We stand ready to assist you and appreciate your business.

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

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