



Ethernet Interface

Application Note

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1 Introduction

This application note describes using the Ethernet interface of Triamec drives. This interface is not an alternative for the synchronized bus interfaces Tria-Link or EtherCAT. It is an alternative to the USB interface and allows configuration and diagnosis of a drive using the TAM System Explorer (>Release 7.6.0).

This interface is currently available for TSD80/TSD130 revision 4 and TSD350 revision 0 with firmware release 4.1.0 or higher.

The main advantage of Ethernet versus USB is the higher immunity level. USB shares a common ground between the PC and the drive. Bad shielding and large electromagnetic interference of motor currents can degrade the noise immunity of USB connections. Ethernet's isolated interface is from its principle better in noise rejection.

2 Configuration

The IP settings may be configured under **General.Parameters.Ethernet**. In most cases, the default values can be used to work with Ethernet:

Use case	Try DHCP. If it fails, use the AUTO-IP adress	Use static settings	Default value
IPv4Setting	DHCP	Static	DHCP
IPv4Address	Used for AUTO-IP, not used if DHCP successful	The static IP address.	169.254.222.222
SubnetMask		The static subNet mask	255.255.0.0
Gateway		The static gateway address	0.0.0.0

A drive can be used as a bridge between Ethernet and Tria-Link. A TAM System Explorer connected over Ethernet will then see all members of the Tria-Link. The mode may be activated on one drive of a Tria-Link only (FW>=4.6.0) using **General.Parameters.BridgeMode = Ethernet**.

3 Connections

The following use cases assume the drive is in the same subnet as the attaching PC.

3.1 Using a dedicated router

We propose attaching all drives of a machine to a (small) dedicated router that will assign the IP addresses (DHCP). Most routers will work in their factory configuration. This router can be connected to the PC either

- using a free Network interface card (NIC) of the PC or
- using a USB to Ethernet adapter.

In both cases the TAM System Explorer will find all adapters and show the drives attached to each adapter independently. Therefore, one machine will be shown under its dedicated router.

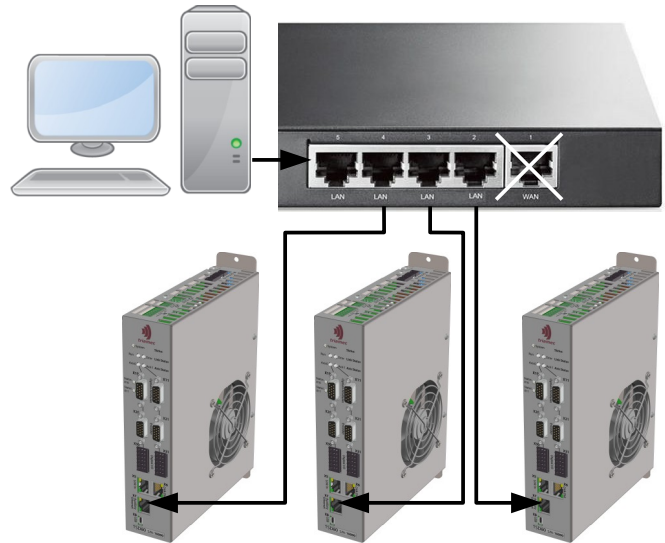


Figure 1: Typical connection of the drives of a machine to a PC through a router.

Hint: A PC can only resolve domain names of one network, usually the principal NIC used for the company network. If a second NIC is attached, the PC cannot find drives by their network names through this card. This is usually not a problem: If the router assigns a dedicated subnet other than the company subnet, the PC can access drives over this card using their IP address and the TAM System Explorer broadcast will find the drives.

A drive can also be routed over WLAN, which might be useful if a Laptop does not provide LAN ports. This approach was tested with the TP-Link TL-MR3020. In its 3G mode (without USB-3G-Stick), it provides the necessary DHCP server. Connect the power supply and the LAN port to the LAN port of the drive. If the router boots slower than the drive, you may have to wait 60s for DHCP retry.

Connect the Laptop to the WLAN of the TP-Link router. Open the TAM System Explorer, which should find the WLAN device.

3.2 AUTO-IP

A drive may also be directly connected to a PC. Leave the IP configuration on the default values (DHCP), see chapter configuration. Since DHCP is missing, it will enter AUTO-IP state after 10s and fix IP settings are assigned, see chapter 2. To allow including an originally missing DHCP router, the drive will restart DHCP search after 60s.

To check the availability of AUTO-IP of the connecting PC: Type "ipconfig /all" (without the quotation marks) in a MS-DOS command line window. If the 'Autoconfiguration Enabled' line says "Yes", and the 'Autoconfiguration IP Address' is 169.254.x.y (where x.y is the client's unique identifier), then the computer is using APIPA. If the 'Autoconfiguration Enabled' line says "No", then the computer is not currently using APIPA.

Note: Fix assignment of an IP address is not a standard behaviour of AUTO-IP. This function is only to be used for direct connection of one drive with one PC. If the drive is to be used in a network without DHCP, use static mode as described in chapter 2.

3.3 Company intranet

Direct connection to a company network is possible but not considered a typical use case. There are security considerations and if attaching multiple machines to a flat intranet, a network discovery will reveal all Triamec drives of all machines, which might not be desired.

An advantage of using this approach: The PC can resolve the network names of the drives, see hint in a chapter above.

4 Facts in short

The following features are supported in firmware release 4.1.0.

- DHCP to receive the IP-address from an attached router
- AUTO-IP or Static IP
- UDP port 47203 to answer “scan” discovery broadcasts from the TAM System Explorer.
- TCP port 47202 for command exchange to up to 4 TAM System Explorers.
- Scope data publishing from drive UDP port 47301 to the TAM System Explorer(s) port shared with TCP-opening port.
- ICMP to respond to ping requests.
- TCP port 80 with a currently very small WEB server.


The drive publishes a network name to a DNS. This name is by default “Triamec-NNN”, where NNN is the serial number. The name can be changed using register *General.Parameters.NetworkName*. Please note the hint on DNS in chapter 3 (“Using a dedicated router”).

5 TAM System Explorer



Network interface cards (NICs) are treated similarly to Triamec Tria-Link PCI cards (p.e. TLO300). That is, a NIC is settled under the local host, while the reached drives appear within the NIC.

5.1 Scan (Discovery)

Note: Discovery is currently disabled by default, since the functionality is considered in beta stage. You may set the *Acquired adapters* preference to *All devices over Ethernet* or *All supported hardware layers* using **File | Preferences....**

During startup, the TAM System Explorer checks for all available NICs and shows them as  icons in the Topology tree.

Note: A NIC must be up (physically connected to some network) to be shown in the application. The TAM System Explorer searches for applicable NICs during startup, but doesn’t anticipate changes to NICs during its lifetime.

Initially, all NICs are enabled. Enabled NICs will scan for drives during startup and manually with  **Scan** in the context menu. NICs can be disabled in the context menu and will remain so at the next TAM System Explorer startup. A disabled card is shown with a different icon () and can be enabled again using its **Scan** context menu.

Note: This enabled state is not related to the operating system feature of enabling and disabling network connections.

During scan, the Explorer broadcasts an UDP message to the subnet of the corresponding card and uses the answers to find all IP addresses of Triamec drives. Then it sets up a connection to all drives of this subnet to display its tree as usual.

Scanning takes time. If the Ethernet interface is unused, you may set the *Acquired adapters* preference to *All devices w/o Ethernet* using **File | Preferences....**

5.2 Scope data of multiple drives

Scoping data from multiple drives is possible if they are synchronized, i.e., in the same Tria-Link or (booted) EtherCAT bus.

Scoping was tested with eight 100kHz publishers of single precision floating-point registers. The performance might degrade when publishing scope data over a heavily loaded company intranet. Typical UDP frames are 1440 bytes. This is expected feasible in a controlled subnet. Publishing over firewalls is not considered a typical use case.

6 Diagnostics

The drive provides a number of signals for diagnostics of the Ethernet interface. The following signals in *General.Signals.Ethernet* show the state of the adapter

Register	Description
<i>LocalIp</i> <i>Mask</i> <i>Gateway</i>	Settings assigned by the external DHCP server (router)
<i>State</i>	<i>Disconnected</i> , <i>WaitForAddress</i> (wait for DHCP), <i>Ready</i> (connected to the router)
<i>MACAddress</i>	The MAC address is stored during production.

Since up to four TAM System Explorer instances (or other observers) can connect in parallel, the following signals are provided for each connecting server in *General.Signals.Ethernet.TriaLinkConnections[]*

Register	Description
<i>RemoteIp</i> <i>RemotePort</i>	The IP and port of the remote server that connected
<i>State</i>	1 = Established, 2 = IdleTimeoutCheck, 6 = Disconnecting
<i>CountTcpRx</i> <i>CountTcpTx</i> <i>ErrorTcpRx</i> <i>ErrorTcpTx</i>	TCP connection data (successful counts and error situations)
<i>CountUdpTx</i> <i>ErrorUdpTx</i>	UDP publisher data (successful counts and error situations)

Please check the following on problems with the Ethernet interface. If the TAM System Explorer does not find a drive,



1. Be aware that a newly attached (USB) Ethernet adapter may take a while to be found.
2. Make sure the PC considers the adapter as a private network.
3. Check the PC's firewall settings of the adapter to be used.
4. Check if the router found the drive and note its IP address.
5. Try ping to see if it answers.
6. Open the IP address using a browser.

If the TAM system explorer suddenly returns “Unresponsive”, this usually indicates, that a drive was disconnected or shut down.

If a TAM System Explorer is suddenly shut down, the drive will close its connection after 60s. Due to a bug in firmware release 4.1.0, all other connections of this drive will also be disconnected in this situation. This is fixed in release 4.1.2.

7 TAM API

When referring to the TAM System Explorer above, this always includes customer applications written against the TAM SDK. This section provides information for programmers about network related APIs.

Each NIC is represented by a `TamAdapter` instance within the local host `TamSystem` instance. These instances implement neither the `IPeripheryLayoutOwner` nor the `IProduct` interfaces, as typical `TamAdapter` instances do.

The remotely accessed drives appear as `TamLink` nodes within the NIC.

Invoking `TamAdapter.Reset(TriaLinkRole.Untouched)` disables a NIC.

Likewise, calling `TamAdapter.Reset(TriaLinkRole.Unknown)` enables a NIC again, or scans for newly accessible devices, while removing no longer accessible devices. Unlike other implementations of `Reset`, this will not recreate `TamLink` instances representing accessible remote devices during scan.

Consider adding a firewall inbound rule for your application allowing for UDP transfers. Otherwise, the application might not be able to connect to the remote host. Refer to the firewall rule for the TAM System Explorer.