Ethernet Interface

Application Note

Version	Date	Editor	Comment
001	2018-12-18	mvx, chm	Initial edit
003	2019-07-01	mvx	Include static IP settings (FW4.6.0) and bridgeMode
004	2021-03-19	dg, mvx, chm	After Review by DG

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Disclaimer

Table of Contents

1 Introduction

This application note describes using the Ethernet interface of Triamec drives. This interface is an alternative to the USB interface and allows configuration and diagnosis of a drive using the TAM System Explorer or other applications based upon the TAM API.

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.

As another improvement over other interfaces, several applications can connect to the drive at the same time. This makes it possible to use the TAM System Explorer in parallel with a browser application, both accessing drive resources.

2 Preconditions

This interface is available for TSD80/TSD130 revision 4 and TSD350 revision 0 with firmware release 4.1.0 or higher. The TAM System Explorer interface is available for release 7.6.0 or newer.

3 Connections

Drives can be connected to a PC using their auxiliary Ethernet connector. This chapter describes how this may be accomplished. After successful connection, the drives may either be accessed by the Triamec Tam System Explorer (chapter 5, as if connected by USB or the PCIe board) or by their internal WEB-site.

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 general purpose Ethernet 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.
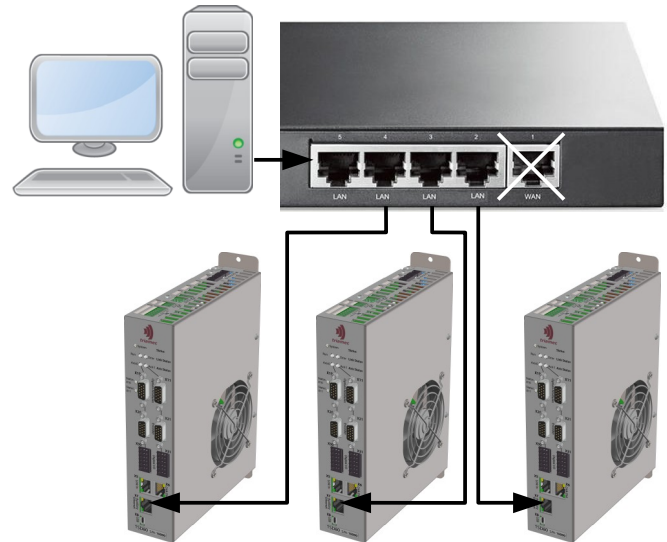

Figure 1: Typical connection of the drives of a machine to a PC through a router.

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 DomainNames (chapter 4) 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 Direct Connection to a PC

A drive may also be directly connected to a PC. Leave the IP configuration of the drive on the default values (DHCP), see chapter 4. Since DHCP is missing, it will enter AUTO-IP state after 10s and fix IP settings are assigned, see chapter 4. To allow including an originally missing DHCP router, the drive will restart a DHCP search after 60s.

If direct connection is not successful check the availability of AUTO-IP (APIPA) 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 non-standard network without DHCP, use static mode as described in chapter 4. This spe-

3.3 Company intranet

Since the drive searches for a DHCP server in the standard settings, it can be connected to a standard Intranet without modification. A Tam System Explorer that is located in the same intranet should find the drive in its standard settings.

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 located in this intranet, which might not be desired.

4　Configuration

For typical Ethernet access as described in the last chapter, the standard configurations may be used. If the user wants to modify the IP settings, use the TAM System Explorer (for example using a USB or Tria-Link connection) to change the settings in the drive register folder **General.Parameters.Ethernet**.

| Use case	Try DHCP. If it fails, use the AUTO-IP adress	Use static settings	Default value
IPv4Setting	**DHCP**	**Static**	DHCP
DomainName	**DomainName, also known as network name. An empty string will set this to "Triamec-{SerialNumber}"**	Not used	Empty string
IPv4Address		The static IP address.	169.254.222.222
SubnetMask	Used for AUTO-IP, not used if DHCP successful	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**.

5　TAM System Explorer

This chapter describes the access of the drives with the TAM System Explorer. If the drives are connected with a method as described in section 3 it should now be possible to access them with the following steps:

- Each drive has to powered on and running for at least 10s.
- Start the TAM System Explorer.
- The accessible network interface cards (NIC) should now be shown in the tree (see 2a).
- To access the drives, execute the 🔍 **Scan** command from the context menu of the NIC which is physically connected to the drive.
- Now the drive(s) should be visible in the tree (2b).

See the next sections for further information about accessing the drive with the TAM System Explorer.
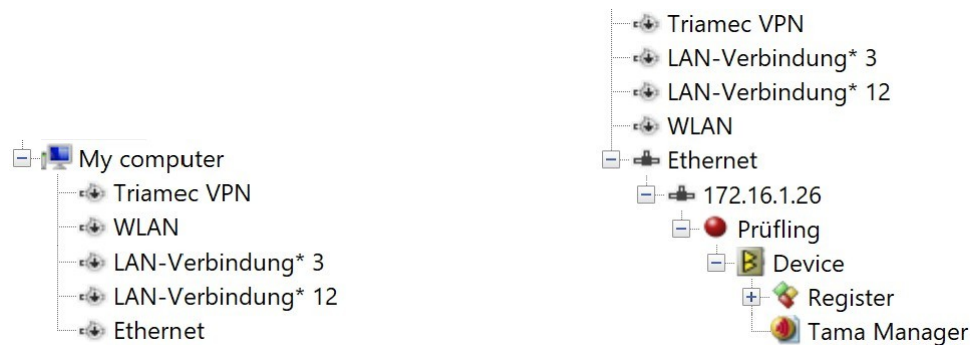
Figure 2: The appearance of Network interface cards (NICs) in the TAM System Explorer
My computer has 5 NICs. We only enable the last one, Ethernet, showing the TSD80-10-TH drive. On the network side, it is represented as 172.16.1.26. That is, it effectively appears twice in the hierarchy, though in different roles.

5.1 NIC Enablement

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.

By default, all NICs are disabled at startup. You must enable a NIC to see the drives attached to it. Do this with the 🔍 **Scan** command from the context menu of the desired NIC. The NIC is enabled, changing its symbol to 🖧 accordingly. The application scans the local network for attached drives, and shows discovered drives under the NIC. Likewise, NICs can be disabled in the context menu. This state is retained across application lifetime..

NIC enablement in the TAM System Explorer is not related to the operating system feature of enabling and disabling network connections. For instance, disabling your primary network connection in the TAM System Explorer doesn't disable it for browsing.

Scanning can result in a startup overhead of several seconds. If the Ethernet interface is unused, you may set the *Acquired adapters* preference to *All devices w/o Ethernet* using **File | Preferences…** in order to gain some time.

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* may be viewed using the TAM System Exxplorer and show the state of the adapter

Register	Description
LocalIp *Mask* *Gateway*	Settings assigned by the external DHCP server (router)
State	*Disconnected*, *WaitForAddress* (wait for DHCP), *Ready* (connected to the router)
MACAddress	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
RemoteIp *RemotePort*	The IP and port of the remote server that connected
State	1 = Established, 2 = IdleTimeoutCheck, 6 = Disconnecting
CountTcpRx *CountTcpTx* *ErrorTcpRx* *ErrorTcpTx*	TCP connection data (successful counts and error situations)
CountUdpTx *ErrorUdpTx*	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 PCs 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: Open a windows cmd-prompt and enter ping followed by the IP address found in the last point
6. Open the IP address using a browser. It should show the WEB-Site of the drive (port 80).

If a TAM System Explorer is shut down improperly, the drive will close its connection after 60s.

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.

You can set up a system specifically accessing NICs only:

```
var system = topology.AddLocalSystem(DataLinkLayers.Network);
```

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.

8   Facts for experts

The following features are supported in firmware release 4.1.0 and newer.

- DHCP to receive the IP-address from an attached router, which falls back to AUTO-IP after 10s. Alternatively, static IP can be set.
- 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 WEB server for filesystem access (AN124).

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.DomainName*. Please note the hint on DNS in chapter 3.1.

During scan, the TAM System 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. It isn't planned to allow a connection set up on an individual basis within a NIC.