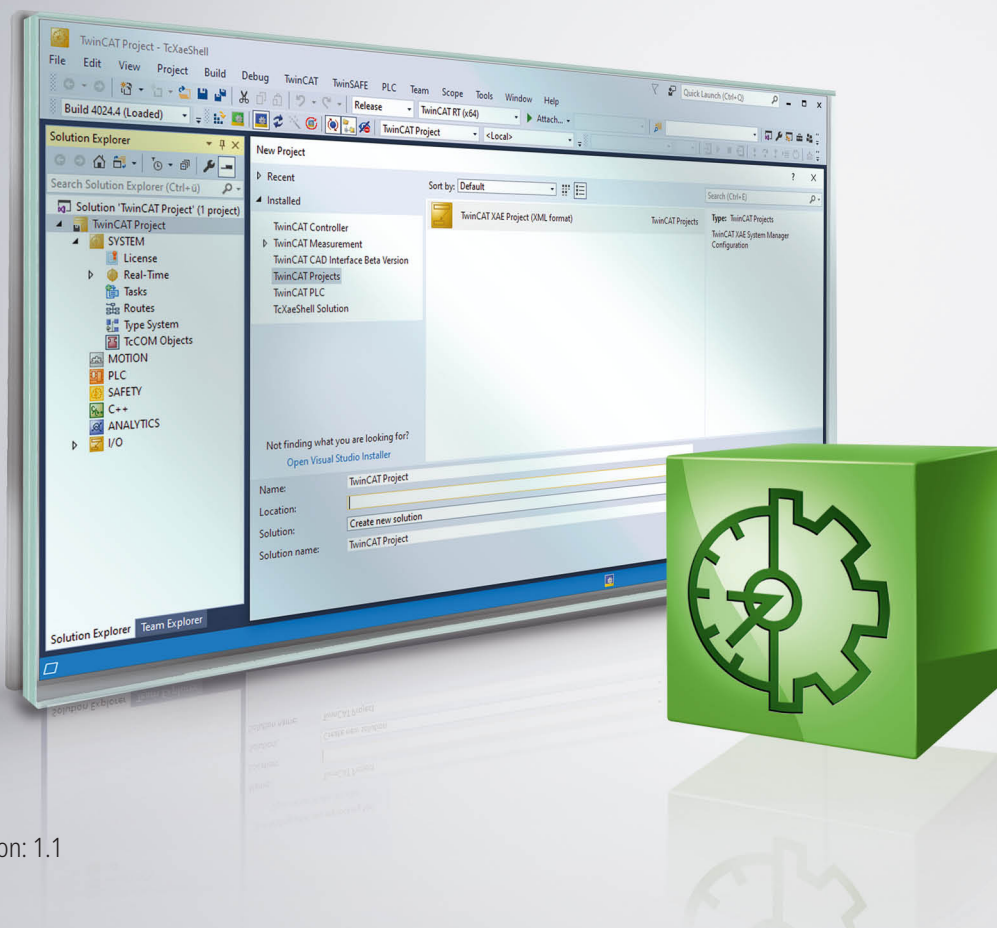


Manual | EN

## TwinCAT 3

AmsNAT





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# 1 Foreword

## 1.1 Notes on the documentation

This description is only intended for the use of trained specialists in control and automation engineering who are familiar with applicable national standards.

It is essential that the documentation and the following notes and explanations are followed when installing and commissioning the components.

It is the duty of the technical personnel to use the documentation published at the respective time of each installation and commissioning.

The responsible staff must ensure that the application or use of the products described satisfy all the requirements for safety, including all the relevant laws, regulations, guidelines and standards.

### Disclaimer

The documentation has been prepared with care. The products described are, however, constantly under development.

We reserve the right to revise and change the documentation at any time and without prior announcement. No claims for the modification of products that have already been supplied may be made on the basis of the data, diagrams and descriptions in this documentation.

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EP1590927, EP1789857, EP1456722, EP2137893, DE102015105702  
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## 1.2 Safety instructions

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Please note the following safety instructions and explanations!  
Product-specific safety instructions can be found on following pages or in the areas mounting, wiring, commissioning etc.

### Exclusion of liability

All the components are supplied in particular hardware and software configurations appropriate for the application. Modifications to hardware or software configurations other than those described in the documentation are not permitted, and nullify the liability of Beckhoff Automation GmbH & Co. KG.

### Personnel qualification

This description is only intended for trained specialists in control, automation and drive engineering who are familiar with the applicable national standards.

### Description of symbols

In this documentation the following symbols are used with an accompanying safety instruction or note. The safety instructions must be read carefully and followed without fail!

#### DANGER

##### **Serious risk of injury!**

Failure to follow the safety instructions associated with this symbol directly endangers the life and health of persons.

#### WARNING

##### **Risk of injury!**

Failure to follow the safety instructions associated with this symbol endangers the life and health of persons.

#### CAUTION

##### **Personal injuries!**

Failure to follow the safety instructions associated with this symbol can lead to injuries to persons.

#### **NOTE**

##### **Damage to the environment or devices**

Failure to follow the instructions associated with this symbol can lead to damage to the environment or equipment.



##### **Tip or pointer**

This symbol indicates information that contributes to better understanding.

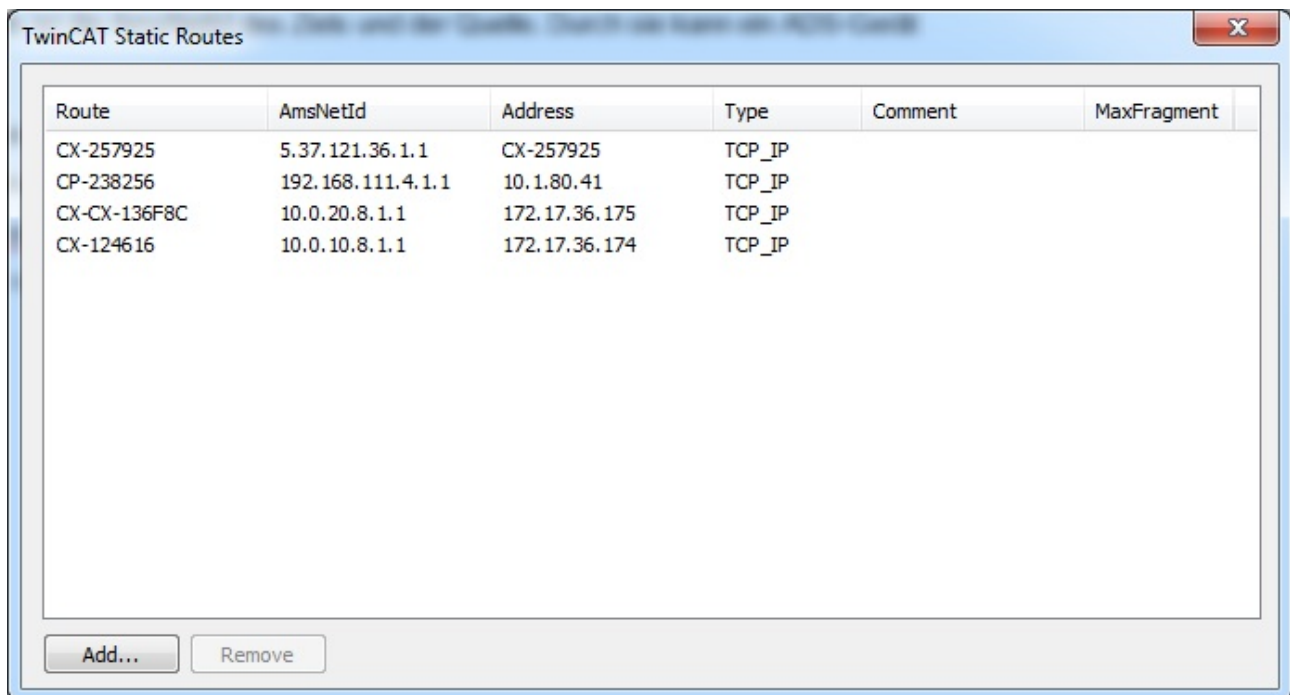
## 2 Introduction

For a better understanding of the AmsNAT function it is important to know the difference between ADS and AMS and to know what an ADS route is.

**ADS** (Automation Device Specification) is the TwinCAT communication protocol that specifies the interaction between two ADS devices. For example, it defines what operations can be executed on another ADS device, what parameters are necessary for that and what return value is sent after execution.

**AMS** (Automation Message Specification) specifies the exchange of the ADS data. A major component of the communication protocol is the AmsNetId. This is specified in the AMS/ADS package for the source and target device. An ADS device can be explicitly addressed using the AmsNetId.

A **route** between two devices must be setup in TwinCAT so that they can communicate. This route is configured on both sides and typically contains the route name, the AmsNetId and the address of the communication partner as well as the type of connection. The configuration of new routes and an overview of existing routes in a TwinCAT system are shown in the following figure.



Route	AmsNetId	Address	Type	Comment	MaxFragment
CX-257925	5.37.121.36.1.1	CX-257925	TCP_IP		
CP-238256	192.168.111.4.1.1	10.1.80.41	TCP_IP		
CX-CX-136F8C	10.0.20.8.1.1	172.17.36.175	TCP_IP		
CX-124616	10.0.10.8.1.1	172.17.36.174	TCP_IP		

If the hardware should be scanned on the target, relative NetIDs have to be used:

Current Routes   Static Routes   Project Routes   NetId Management

Local NetId:

Target NetId:

Project NetIds:

NetId	Owner	Type
-------	-------	------

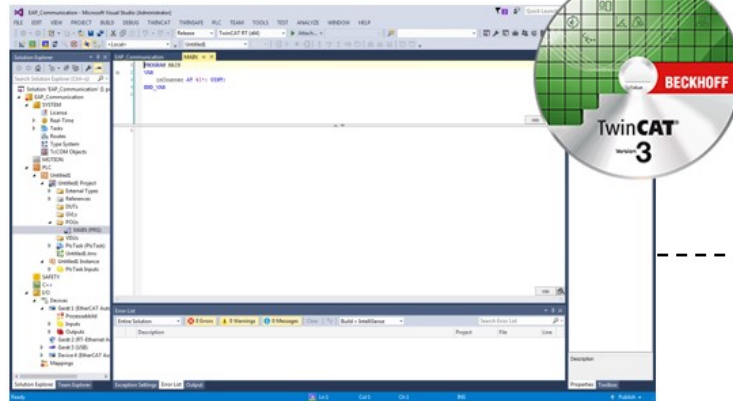
Use Relative NetIds



### 3 General description

The AmsNAT function enables XAE systems to establish routes to two or more controllers having the same AmsNetId (Figure 2). Beyond that, AmsNAT offers a solution with which different ADS devices with the same AmsNetId can communicate with one another via ADS. Virtual AmsNetIds are used with AmsNAT. A virtual AmsNetId is a unique address for a connected ADS device that is replaced by the real AmsNetId of the target system during communication. This means that the AmsNAT function ensures, in all communication that takes place via ADS, that the AmsNetId of the target system is replaced.

#### XAE



Virtual-AmsNetId	Remote-AmsNetId	IP-Address
10.0.10.8.1.1	5.19.8.122.1.1	10.0.10.8
10.0.20.8.1.1	5.19.8.122.1.1	10.0.20.8
...	...	...

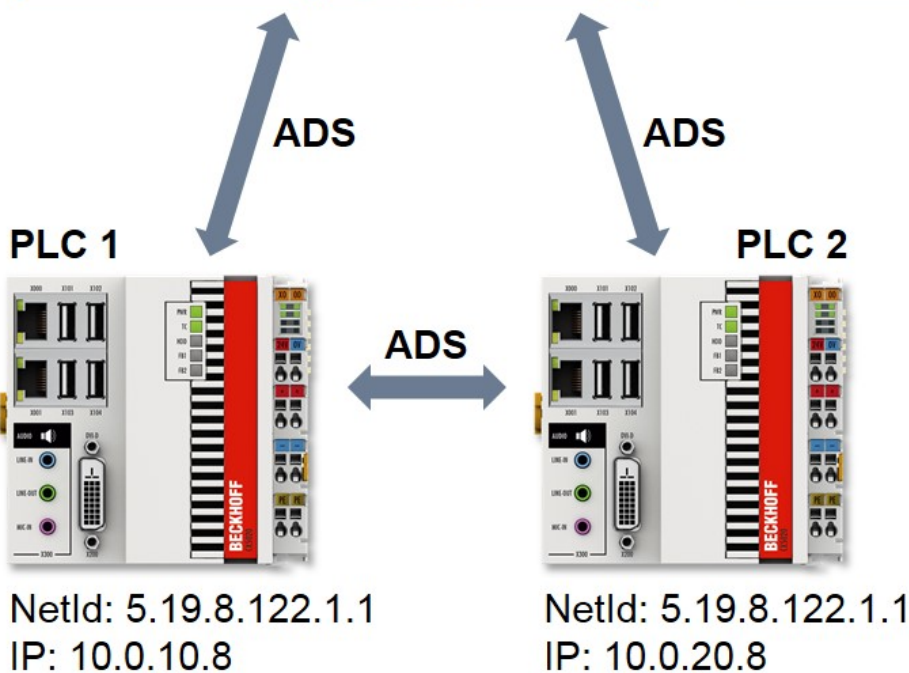


Fig. 1: Communication with/between TwinCAT systems with the same NetId

## 4 Motivation

A frequently occurring application in series mechanical engineering is the cloning (i.e. the making of a 1:1 copy) of a controller. When using TwinCAT, the result of this is that all cloned instances possess the same AmsNetId. This is not a problem at first. However, if the cloned instances are to be connected in parallel with the same engineering system or are to communicate with one another by ADS, this is initially impossible because the AmsNetId is not unique. The AmsNAT function removes precisely this restriction by virtue of the fact that the systems work with virtual AmsNetIds. These can be configured with very little effort.

The AmsNAT function can be used for any route to an ADS device. This provides a high degree of flexibility and the AmsNetIds no longer have to be adapted to the machine computers, which leads to a significant reduction in time and effort for configuration.

# 5 Functioning

The way AmsNAT functions will now be explained on the bases of a typical application. In the application case, a TwinCAT engineering system and two TwinCAT runtimes exist with the same AmsNetId and IP address. The configuration is illustrated in Figure 3. The engineering system is to send an AdsRead command to PLC 1, from which a corresponding response is expected. Since both runtimes possess an identical IP address, two IP NATs are additionally used. Their task is to implement unambiguous addressing. In order to do so, the first three positions of the local IP address are replaced by the first three positions of the global IP address or vice versa, depending on the direction of communication.

In the first step of the application example, the engineering system sends an AdsRead command to PLC 1. Since this AmsNetId is a virtual one, the TwinCAT system service replaces it by the remote AmsNetId 5.19.8.122.1 with the help of its routing table. This is the real AmsNetId existing on the system. It is entered in the field "AmsNetId Target" of the AMS packet.

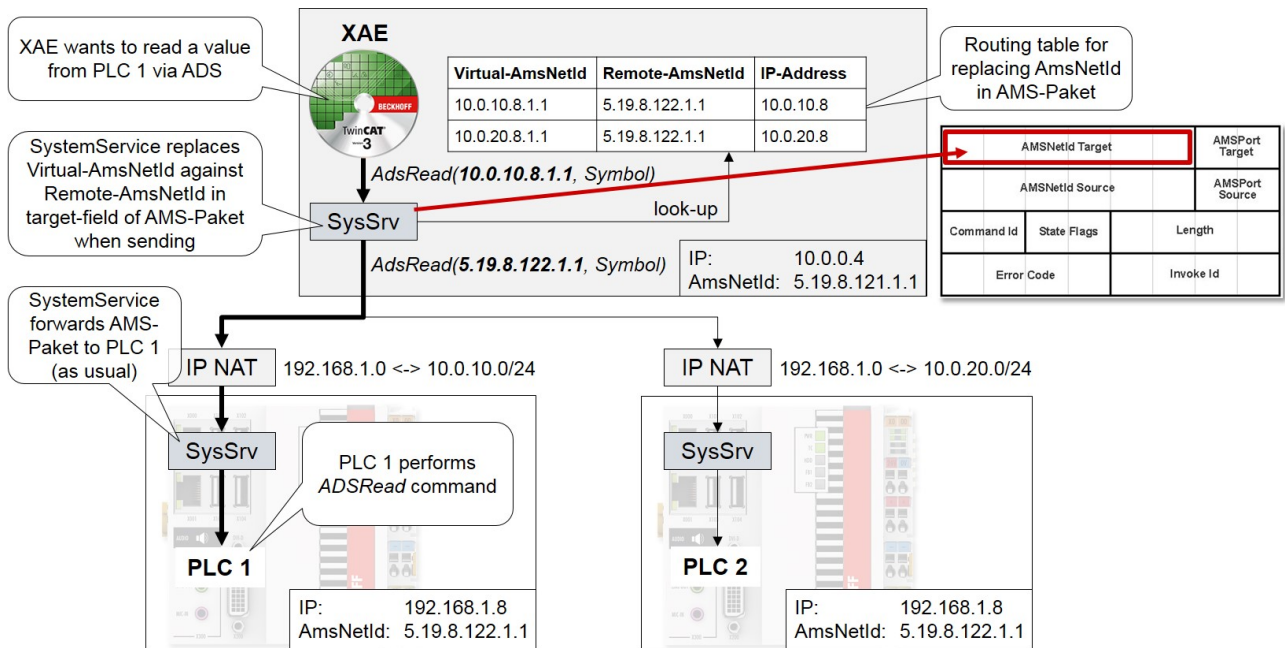


Fig. 2: Sequence for sending an AdsRead command using AmsNAT

The TwinCAT system service of PLC 1 relays the AMS packet unchanged. PLC 1 executes the AdsRead command and then sends the corresponding response to the engineering system. Figure 4 shows the communication sequence for the response.

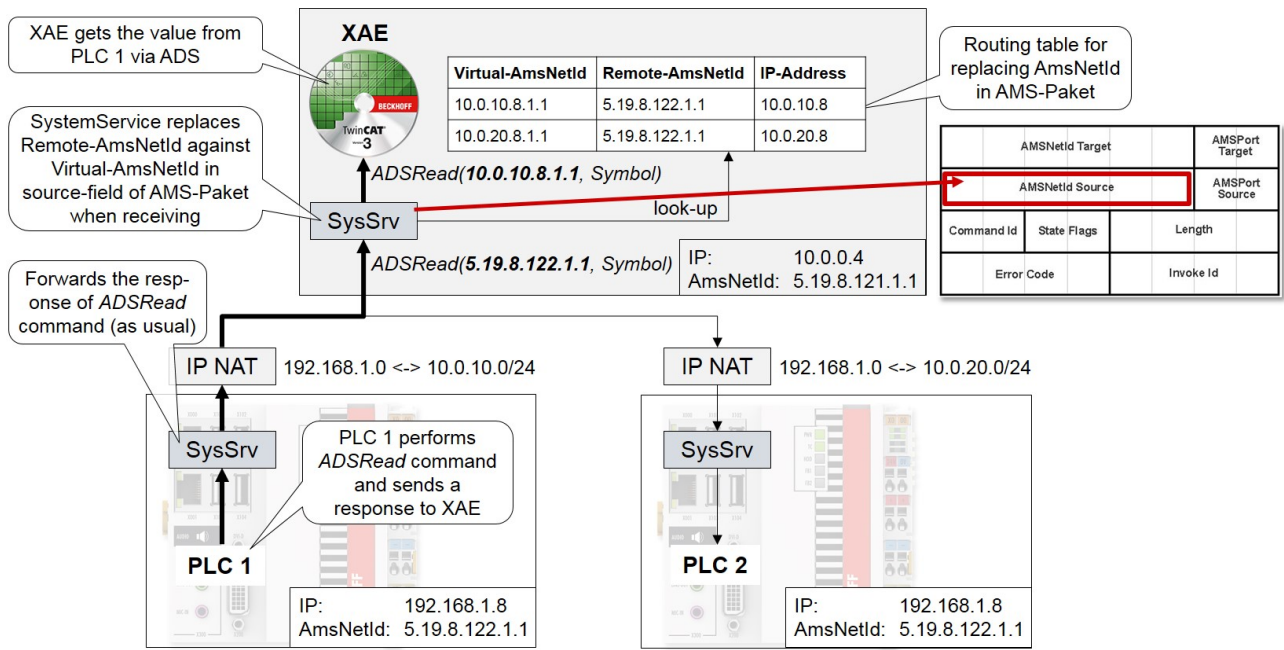


Fig. 3: Sequence for sending the response to an AdsRead command

For the response, the TwinCAT system service of PLC 1 initially relays the AMS packet unchanged. It subsequently reaches the TwinCAT system service of the engineering system. Since the real AmsNetId of PLC 1 is entered in the field "AmsNetId Source" of the AMS packet, it must be replaced by the virtual AmsNetId on the basis of the routing table. The engineering system can then clearly assign and process the response.

When using the AmsNAT function the transmitted data are not changed, only the AMS header. Therefore it should be noted that if configuration data contain the AmsNetId this can lead to the virtual AmsNetId being used. One possibility for the engineering of I/O devices is the use of relative AmsNetIds. In this case the last two characters of the AmsNetId are taken into account and the first four characters are ignored.

## 6 Configuration

To configure AmsNAT, open the file *StaticRoutes.xml*, which is located in the TwinCAT installation directory under the path *TwinCAT\3.1\Target*. In this file, define the attribute "RemoteNetId" for each route as shown subsequent.

```
<?xml version="1.0" encoding="UTF-8"?>
<TcConfig xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xsi:noNamespaceSchemaLocation="http://www.beckhoff.com/schemas/2015/12/TcConfig">
  <RemoteConnections>
    <Route>
      <Name>CX-111111</Name>
      <Address>10.0.10.8</Address>
      <NetId RemoteNetId="5.19.8.122.1.1">10.0.10.8.1.1</NetId>
      <Type>TCP_IP</Type>
    </Route>
    <Route>
      <Name>CX-222222</Name>
      <Address>10.0.20.8</Address>
      <NetId RemoteNetId="5.19.8.122.1.1">10.0.20.8.1.1</NetId>
      <Type>TCP_IP</Type>
    </Route>
  </RemoteConnections>
</TcConfig>
```

The actual AmsNetId assigned to the remote ADS device is specified with the attribute "RemoteNetId". It does not have to be unique. Only the AmsNetId of the target system defined in the field <NetId> is known in the TwinCAT system with configured AmsNAT function.

Restart the TwinCAT system service in order to activate the preset configuration of the AmsNAT function. To do this, switch the TwinCAT system from Run mode to Config mode. If TwinCAT is already in Config mode, reopen this in order to load the settings made.



More Information:  
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