ENGINEERING
TOMORROW

Operating Guide

Connecting ECL Comfort 296 / 310 controller via 3G / 4G to SCADA server

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2.0 Introduction

2.1 Use 3G or 4G mobile internet connection when wired internet connetion is not available

The ECL Comfort 296 / 310 controller can be connected to a SCADA system via a 3G or 4G mobile internet connection if a wired internet connection is not available. Some important limitations and restrictions apply however, if a 3G or 4G mobile internet connection is used.

Mobile internet connections are in general to be considered as being less reliable and having lower data throughput than wired internet connections.

2.2 Designed to handle mobile internet

When a connection is less reliable then the SCADA server and the ECL Comfort 296 / 310 controller may experience the connection to be lost.

This situation sets higher demands for mechanisms to re-establish the connection and also higher demands for retransmission and error handling mechanisms.

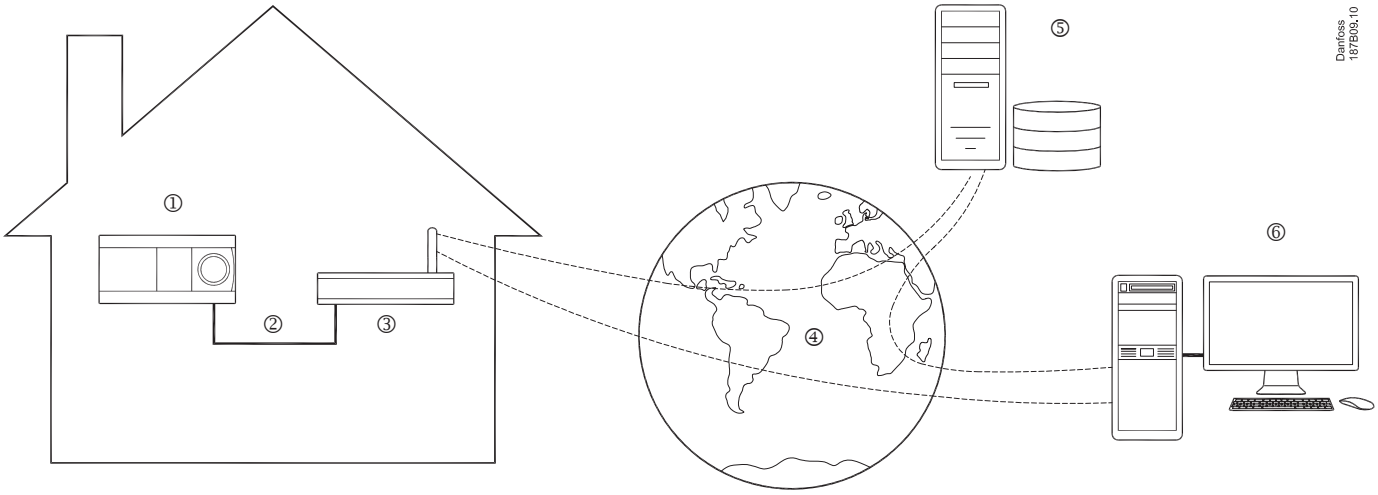
The Danfoss ECL Comfort 296 / 310 controller and OPC Server are designed to handle mobile internet connections being less reliable than wired internet connections.

The OPC Server software must, however, be configured accordingly.

3.0 System overview

3.1 3G / 4G data connection set-up for SCADA systems

The components are shown in the drawing below.



① ECL Comfort 296 / 310 controller
② Ethernet
③ 3G modem
④ Internet
⑤ DynDNS service provider
⑥ SCADA server with OPC server software

3.2 3G and 4G connections

The data throughput is typically lower in a 3G or 4G mobile internet connection than in a wired internet connection. 4G is though faster than 3G. Data throughput depends on both the bandwidth and also on the latency time.

Bandwidth on fast 3G or 4G connections may be comparable to bandwidth of wired internet connections in ideal situation, but it may be affected by signal quality, signal strength and often depends also on other users utilization of the total bandwidth available from the mobile internet connection provider's antenna.

Latency time is though significantly longer in mobile internet connections which results in significantly reduced performance of the Modbus protocol.

The OPC Server must be configured to tolerate this longer response time to requests. The performance of the SCADA system also benefits from limiting the amount of data and sensor values etc. requested from the controllers.

3.3 IP addressing

IP addressing is also often different from wired internet connections as mobile internet connections typically use a dynamic private IP address which is renewed/changed regularly and static IP addressing is seldom an option.

It must be ensured that the IP address of the 3G modem is public instead of private, i.e. accessible by other devices/servers on the internet.

The IP addressing topic is important to SCADA systems as the communication scheme typically used is that the SCADA server initiates Modbus-TCP connections to the ECL Comfort 296 / 310 controllers and therefore needs to know the IP addresses of the controllers.

3.4 DynDNS service

To avoid the need for a static IP address of the 3G or 4G modem the DynDNS service can be used.

This service translates a URL, which is user defined, but unique to each modem, into the current IP address of the modem.

The modem must send its IP address to the DynDNS service provider whenever its IP address changes.

The SCADA server will then be able to access the modem by addressing the URL of the modem.

The modem must support the DynDNS service and an account at the DynDNS service provider must be available.

3.5 Costs

Costs typically apply to mobile internet connections which are based on the amount of data transferred to and from the modem.

In the calculation of the data transmitted to and from the modem not only the known data generated by the SCADA server is included, but also any other irrelevant and unwanted data transmitted by other devices on the internet to the IP address of the modem.

Flat rate subscriptions may be an alternative to achieve a fixed cost independent of transmitted and received data.

Another alternative is a private network or virtual private network (VPN) which ensures that only the controllers and SCADA server within such network can exchange data.

4.0 Components overview

Please see 'System overview' on page 2 where the placing of the components is shown in a drawing.

4.1 ECL Comfort 296 / 310 controller

- Connected to 3G modem via Ethernet cable
- Configured for STATIC IP

4.2 3G modem

- 3G modem with Ethernet interface
- Built in router. The router must be configured to forward incoming traffic from WAN to LAN on TCP Port 502 to the IP address of the ECL Comfort 296 / 310 controller.
  Preferably, it should forward only the traffic received from the IP address of the SCADA server.
- Built in firewall. The firewall must be configured not to block incoming traffic from WAN to LAN on TCP Port 502.
- Built in support for DynDNS (preferred). DynDNS must be configured to use the user's DynDNS account. If DynDNS is not used/supported then the IP address on the WAN side of the 3G modem must be public and static (special subscription at mobile internet service provider is typically needed).

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Security note:

The Modbus/TCP implementation guide does not specify a specific security model.

The ECL Comfort 296 / 310 controller does not use any form for access control restriction and it is therefore strongly advised to only use it on a secure network where a router/firewall provides security to other local networks or the internet. In most routers it is possible to set simple access restrictions for which kind of internet traffic that are allowed to reach the ECL Comfort 296 / 310 controller.

Modbus/TCP communication is not affected by the removal of the key from the ECL controller. It is still possible to change all settings through communication even if the key has been removed in order to prevent this!

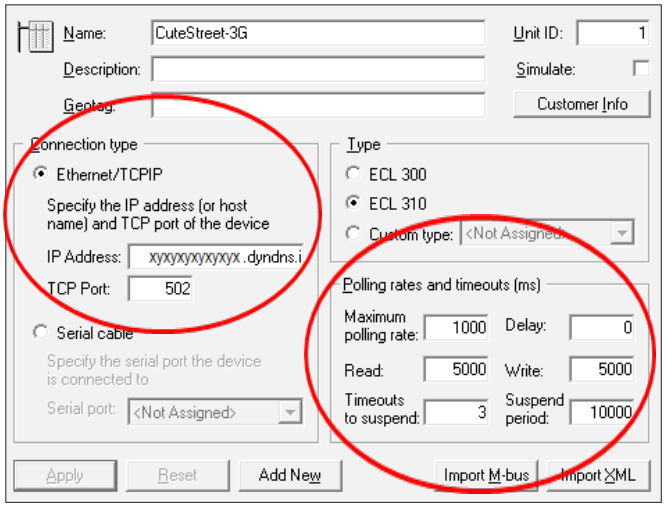
4.3 DynDNS service provider

- User account at DynDNS service provider must be created.
- The URL specified by DynDNS for the 3G modem, i.e. xyxyxy.dyndns.info, must be known.

4.4 SCADA server with OPC server software

- Must have OPC Server for ECL Comfort 296 / 310 controller installed.
  The devices (ECL Comfort 296 / 310 controller communicating via 3G)
  created in the OPC Server must be configured to use Modbus-TCP connection to the URL specified by DynDNS and TCP Port 502.
- Polling rates and timeouts must be specified carefully to achieve reliable communication via 3G. Max. polling rate may have to be increased from default value. Read and write timeouts typically have to be increased from default values, i.e. to 5000ms. The suspend period, e.g. the period a device is suspended from communicating if some timeouts (timeouts to suspend) have occurred, may also have to be increased from defaut value.

See example on the other side of page.



Screenshot of the OPC Server software for ECL Comfort 296 / 310 controller.
The example indicates important settings to make when using a 3G / 4G connection.

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