

## System description

# Monitoring and Control System

The Vertex Monitoring and Control System (M&C System) is a complete control instrument for the control and monitoring of satellite earth stations.

The use of standard networks (LAN) allows to control and monitor any number of antennas, with the server assigning an independent antenna software module to every antenna. The server(s) is(are) connected to the antenna equipment devices by means of IP connections (TCP or UDP). Media converter devices are used to connect devices which provide interfaces such as RS 232, RS 485 or GPIB instead of a LAN port.

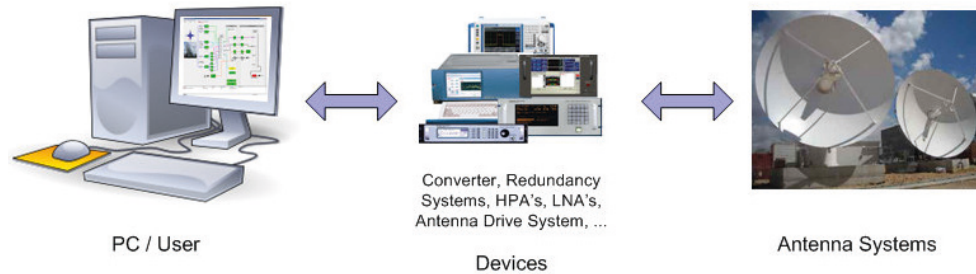
The client-server structure enables a mobile operation independent from the location. Graphical interfaces ensure a user-friendly handling. The clients which communicate with the servers through a LAN have options to access every antenna module, thus every antenna can be controlled and monitored through each client. The administrator can implement

various access controls and operating options to be defined in hierarchical levels. The modular structure of the software allows for customer specific adaptation and enhancement. Adaptations to future requirements and extensions can be realised on an individual basis. The use of standardised hardware and software components ensures easy installation and testing.

Interaction with higher level M&C systems can be implemented through a remote interface. The compliance with high requirements on interference immunity, reliability, access safety, very short access times, protected data transmission and special functions in the field of signal processing is ensured.

# System Layout

The Vertex M&C system splits the device access to hardware and software levels into several authority levels.



## Characteristics Overview

Characteristics Overview	Standard Version	Optionally available
Use of standardised PC hardware	X	
Operating system Windows 10 / Windows Server 2016/2019 or newer	X	
Antenna-specific drivers	X	
Antenna-specific graphical user interface (GUI)	X	
Graphical representation in several levels with an increasing degree of detail	X	
Transparent, unified colour symbol identification of the different operating states	X	
Coloured representation of RF signal flow	X	
Multi-level password protection / hierarchical access control	X	
Easy integration of customer-specific control and monitoring devices	X	
Application of customer driver software	X	
Parameter driven logging system	X	
Remote maintenance and access to parameters	X	
Client-server structure	X	
Remote Protocols ( Http/Web, Binary Remote Protocol, Telnet, etc.)		X
SNMP Agent		X
Profiler (Store/Load Device Settings)		X
Multi Mission Scheduler (MMS)		X
Automatic antenna measurements (Pattern)		X
Uplink Power Control		X
Customer-specific interfaces		X

## Hardware Levels

The antenna and its transmitting and receiving paths are monitored and controlled through different devices. Each device is equipped with one proprietary administration interface. In most cases these are interfaces of type ethernet which can be connected directly to the M&C hardware. Interfaces of type serial RS232, RS485 or GPIB are converted onto a LAN by means of media converter. Due to this, all devices can be addressed through IP (TCP/UDP) on a standard basis. Another benefit of this system is the easy scalability, as no intervention in the computer is required. Only one network interface is required to access all devices.

## Software Levels

On the PC side, all devices can be addressed through TCP/UDP socket programming on a standard basis. Each proprietary interface protocol is related to one device driver which carries out the conversion into an internal standard interface. The internal interface to a device driver is fully independent from the underlying proprietary protocol. This technology enables an easy to realise extension of the software by new device drivers, without any need to newly programming the internal interface. A software module encapsulates a device driver. The GUI display (dialog) of a device is flexible and can be customised to fit customer needs.

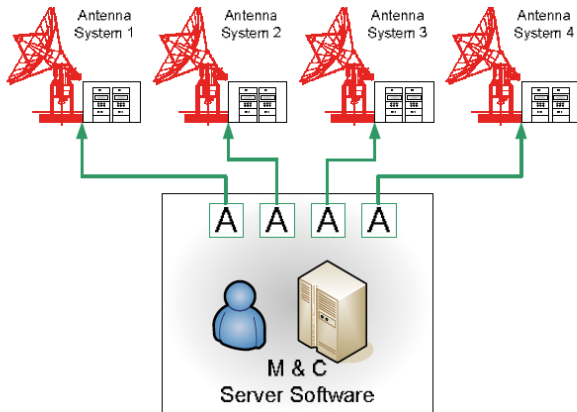
## Client / Server PC - System Requirements

The minimum requirements for the operation of M&C systems are a commercial PC with a 2 GHz processor, 2 GB RAM as main memory, min. 20 GB hard disk and one graphic card with a resolution of min. 1024 x 768 pixels. As operating system Windows 10 / Windows Server 2016/2019 or newer is supported.

## Software

The M&C software runs under Microsoft Windows and is designed for continuous operation. During the installation of the software, a corresponding link is placed in the Autostart directory. Thus, the software is started automatically upon each start-up of the computer. Clients of the M&C system run on Windows 10 or newer. Each antenna is internally represented through a module.

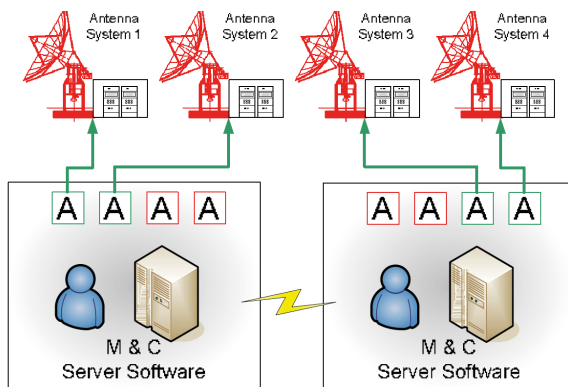
# Configuration Overview



## Central Server

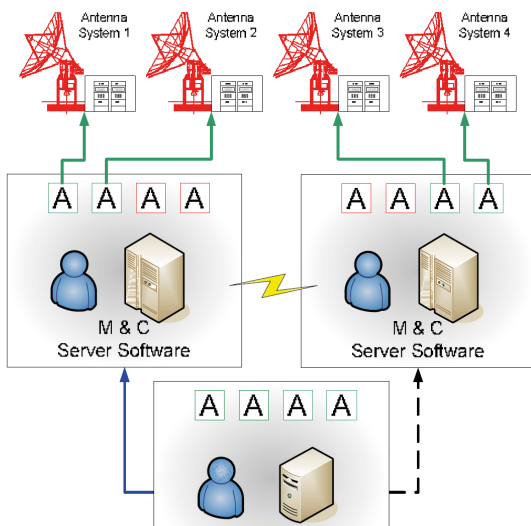
Within the software, each antenna is represented by an antenna module.

Any number of servers can be used, with one server capable of administrating any number of antenna modules.



## Decentralised Server

In addition the different antenna modules can be assigned to any number of servers.



## Client / Server

One client can get all data from one particular server. The clients can connect individually with any server required. Any number of clients can be installed.

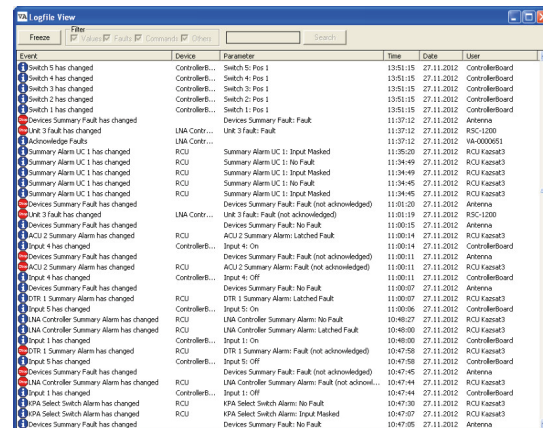
# Multi Mission Scheduler (MMS)

The MMS is a M&C subsystem which creates a tracking list for several satellites based on Two-Line-Elements (TLE).

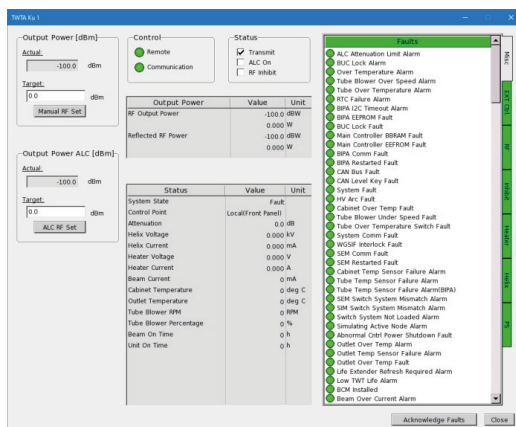
Prior to each scheduled event the MMS automatically commands all connected devices (Servo-, RF- and Base Band subsystem) to assume the configuration associated with of the next satellite.

Customised search period	Calculation of maximum elevation angle
Input of minimum satellite elevation	Automatic Tilting
Creating prediction tracking list	Automatic cable de-wrap
Creating of a visual tracking time schedule	Collision note display
Parameterization of the complete ground station	Automatic collision prevention (priority list) or manually
Calculation of AOS (Acquisition of Signal)	Data logger for each satellite pass
Calculation of LOS (Loss of Signal)	Graphical User Interface (GUI) for best overview

# Sample Screenshots

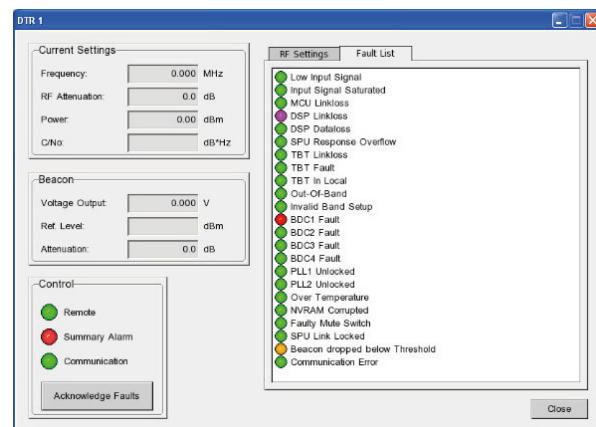


## Graphical ACU dialogue



## Status message of High Power Amplifier

## Sample log file with events



## Status message of Digital Tracking Receiver

## Colour Legend

Colour	Meaning
Grey	The device was deactivated by a user. The communication to the device is turned off.
White	There is no connection to the device.
Purple	If there is a fault in the device, it is not shown in the current level.
Red	A fault occurred in the device.
Pink	A fault has occurred but the device is ready again.
Orange	There is a warning from the device.
Yellow	The device is in local mode.
Light green	One or more faults of the device are masked out.
Green	The device is ready to use.

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