



WIR VERSTEHEN DIE ZEICHEN DER ZEIT
KEEPING PACE WITH THE SIGNAL OF TIME

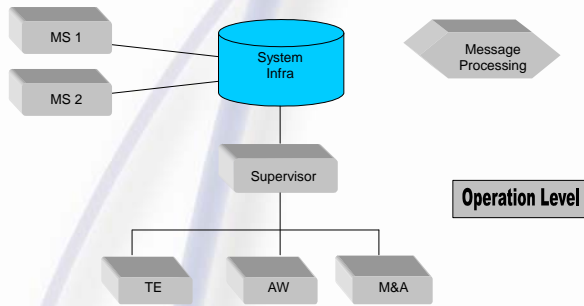


TRS-8000

Traditional Reconnaissance System

Efficient and easy-to-use system to process
complex reconnaissance tasks in
wideband and narrowband scenarios

TRS-8000 in a few Words



TRS-8000 is a traditional reconnaissance system. It receives tasks from the intelligence processing department to whom it returns the results and who then gains further insights from the results. Parts of the insights may flow into the basics that are maintained by the intelligence processing department.

What is processed and how?

TRS-8000 gathers HF/VHF/UHF signals, determines their technical and operational parameters, and - if possible - the contents of the message in speech, Morse, and data transfer traffic. TRS-8000 can handle known emitters as well as only partially known or new emitters.

The system is operated from different work places by operators taking different roles within a specific workflow. The work places are usually off-the-shelf PCs (Linux or MS-Windows) providing specific graphical user interfaces according to each role.

The workflow starts with a reconnaissance task from the intelligence processing department. This is processed by the different TRS-8000 operators and finally returned with an appropriate reply message containing information, records and analysis results, depending on the equipment in use and the reconnaissance requirements.

Reconnaissance Task

The reconnaissance task is a request to monitor a frequency spectrum for emissions. Therefore, operators set up their receiver to scan these spectra and then listen to the audio output. If they hear a relevant signal, they stop scanning and focus to the current emission. They can e.g. record the signal and forward it to further processing for more detailed results that are then summarized to a message.

Within TRS-8000, the supervisor transforms the reconnaissance tasks into a plan for the system and allocates tasks to work places. The operators work on the tasks until the required information is gathered and returned as a message.

Different types of work places are available for different types of tasks and to gather different types of information in different situations.

The TRS-8000 staff is supported by information (basics) taken from an external and an internal knowledge base into which the results of the task may flow in turn.

The system is described in more details in the following.

Overview of the Process

What it is about

The goal of the TRS-8000 system is to respond to a reconnaissance request with a complete and accurate reply. Thereby two types of tasks exist: acquisition tasks and search tasks:

- an **acquisition task** requests information on an emission, such as sender and receiver, transfer time and duration, frequency, content etc.
- a **search task** requests information on the existence of emitters within a frequency band to be scanned. If emitters are detected, classification should determine their parameters. The results can be used to parameterize hand-off receivers.

Supervisor and monitoring operators ascertain the requested information and edit a message that is stored on a central server to supply it to the intelligence processing department.

The system provides different types of work places at which a team of supervisor and operators work on the different tasks.

Supervisor Work Place

The supervisor receives reconnaissance tasks from the intelligence processing department and transforms the tasks into processing plans and separate sub-tasks for TRS-8000 (search and acquisition tasks). Then he distributes the tasks to the operators of the subordinate units.

Monitoring Work Places

The monitoring operator inserts the task into his processing schedule by assigning it to an acquisition chain (a predefined signal path from an antenna to specific outputs).

When doing so he can select from existing step lists or create new step lists. The step lists are sequences of receiver parameters a receiver applies one after the other step by step. Then he starts the processing of the step lists for all of his tasks.

He listens to the signal received at each step using loudspeakers. When he detects a relevant signal, he proceeds as follows:

- he stops the acquisition chain control
- he edits a message
- he may record the signal and listen to the signal
- forward message and results for further processing

Subsequently, he continues the task processing as defined in the step lists.

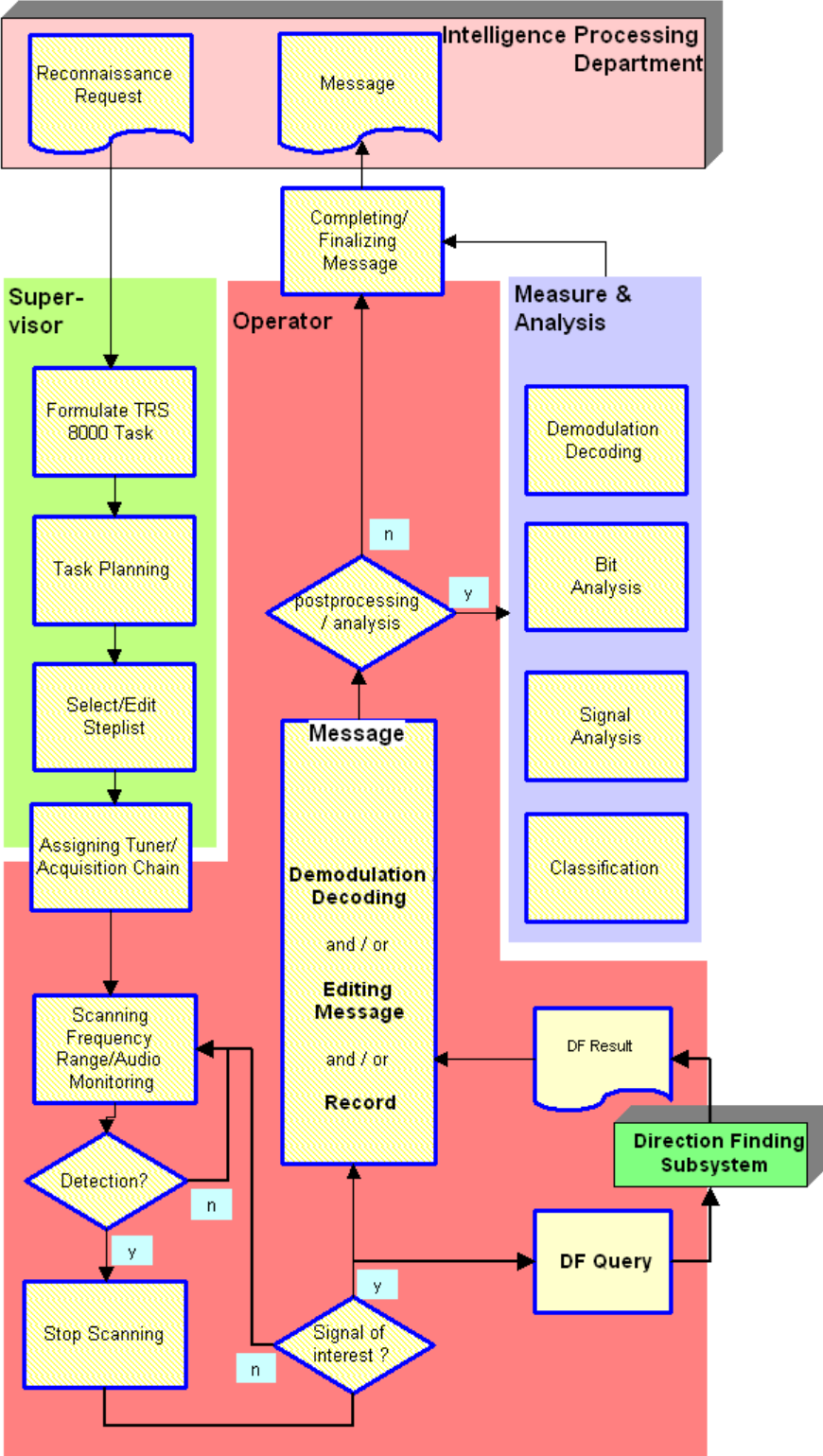
Work Places: There are two types of work places operated in a very similar manner - the difference is that the focus of the technical extraction (TE) is determination of the technical properties of the (digital) signal, the focus of the Morse and speech extraction (MO) is the determination of the contents of analog audio signals.

The work places are equipped differently to meet these different requirements.

Overview of the Process

Flow Chart

The flow chart roughly displays the steps through the work flow, names the involved instances and shows which step is performed at which work place.



The next sections introduce the supervisor and monitoring operator roles in more detail.

Supervisor

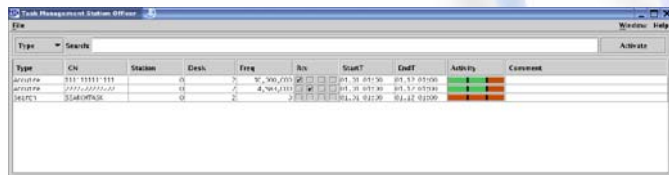
After logon, the supervisor accepts reconnaissance tasks and plans and schedules who and how they are processed.



As a preparation, he first plans how the reconnaissance tasks are to be processed. From existing tasks, one or more single tasks per reconnaissance task may be created.

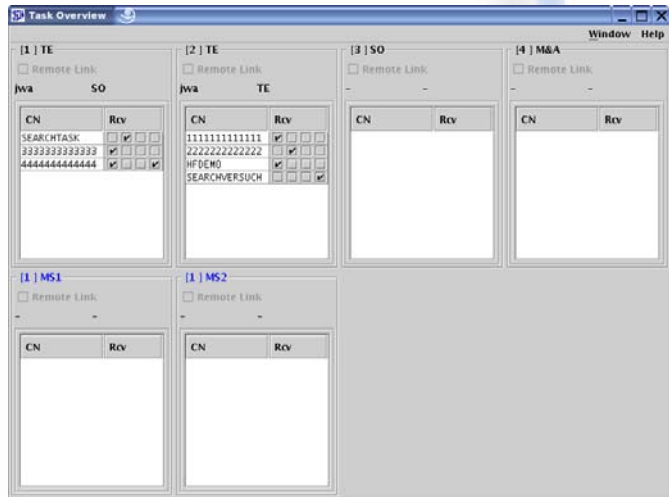
Also, the corresponding basics of each task can be viewed.

To control tasks, they are assigned to work places in the office or a subordinate office. The supervisor of the subordinate office gets a message and assigns the task to the operators in his office in turn.



The TRS-8000 system provides information about the current task status in different ways, and there are different ways to work on the tasks. The tasks can be assorted, searched and filtered.

A graphical task overview display shows the distribution of tasks at the different work places. The supervisor can hook on a work place to monitor the monitoring operator.

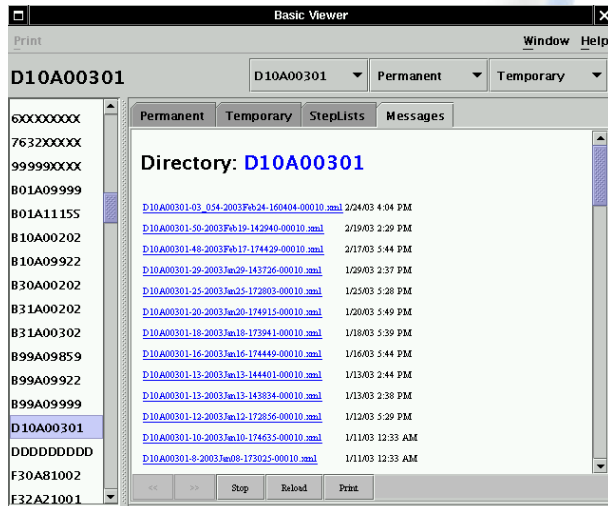


Basic Viewer

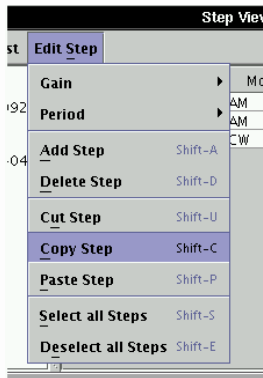
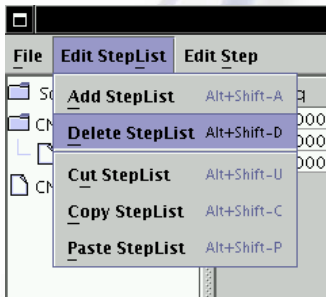
The **basic viewer** window shows the basics of a task.

There are permanent and temporary basics

- Permanent basics are made available by the intelligence processing department.
- Temporary basics can be results of reconnaissance.



Step Lists



A step list is a sequence of receiver parameter sets to be processed one after the other by a receiver. For each task there may be one or more step lists. Predefined step lists derived from the basics can be used or a step list can be composed especially for a task.

In sweep mode, a frequency range can be comfortably set up to be scanned in one go.

Act	Freq	Efreq	DFreq	BW	Mod	Ant	BFO	GainCtrl	Gain	S/N a	S/N	EMZ	Work	Per	DM	Scan	Trans
	10,000,000	250,000	100	3,000	AM	HF1	800	AGC-Fast	10	<input type="checkbox"/>	0	<input type="checkbox"/>	+ 1 s	5	<input type="checkbox"/>	Detect	sitor
	100,000,000	250,000	100	3,000	AM	HF1	800	AGC-Fast	20	<input checked="" type="checkbox"/>	0	<input type="checkbox"/>	+ 1 s	5	<input type="checkbox"/>	Detect	Default
	4,583,000	250,000	100	3,000	AM	HF1	800	AGC-Fast	20	<input type="checkbox"/>	0	<input type="checkbox"/>	+ 1 s	5	<input checked="" type="checkbox"/>	Detect	Wetterfunk

Operator Work Places

Type	CN	StartT	EndT	Comment
Acquire	1111111111111111	01.01 01:00	01.12 01:00	
Acquire	2222222222222222	01.01 01:00	01.12 01:00	
Search	SEARCHTASK	01.01 01:00	01.12 01:00	

After logon, monitoring operators can view the tasks the supervisor assigned to them.

The task table can be sorted and filtered.

Controlling the **Acquisition chain** means to control the receivers and to assign reconnaissance tasks to them. Depending on the receiver type used, different parameters can be adjusted to control the receiver and improve the signal quality.

Goals can be to determine the receiving parameters (antenna, frequency, bandwidth, modulation, etc.), or to detect emissions and emitters and/or to get the contents of emissions.

After having created and started the step lists, the operators listen to the receiving signal while the step lists are being processed (monitoring).

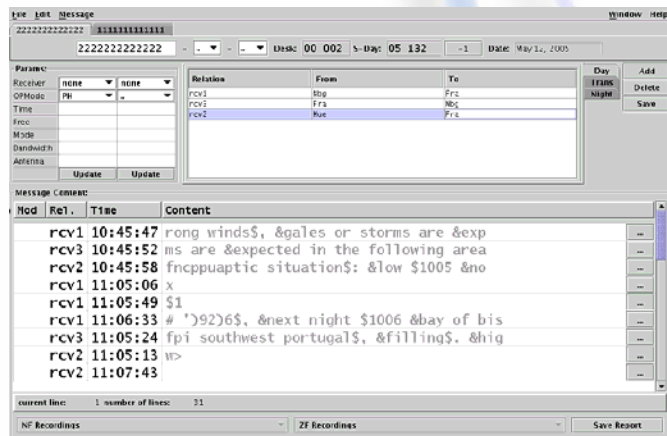
The audio signals received are played over loudspeakers. Operators adjust which signal they want to have played over which audio output channel and with which volume.

Detections

When an operator or automatic detector detects a signal, he stops the step mode of the receiver and can take measures to improve the signal (fine tuning, applying filters or gain control, classification, demodulation, decoding, etc.) and can record the signal. If it is a non-encrypted speech signal or Morse signal, the operator can write down what he hears otherwise the demodulator and decoder write text into message. The system notifies the supervisor when an operator stops his receiver.

The operator or system writes contents and attributes in a message. A message may contain:

- all receiving data
- written down message content (if something has been written down)
- demodulate and decoded text
- the recorded signal
- journal data



The message can be temporarily stored on the local system for further processing. If the message is complete (with or without post-processing) it is returned to the intelligence processing department who once started the task. Depending on the relevance of the results, they may be incorporated into the permanent basics and thus help e.g. to process subsequent reconnaissance tasks.

Alternatively, if the task requires signal production, the determined parameters can be used to adjust an optional hand-off receiver. The hand-off receivers produce detected channels (=receive, demodulate and store the signals for later analysis).

Further Options

Depending on the requirements, the operator work place can be enhanced about options to improve the effectiveness of the operators. Currently available options are:

- **Signal Classification:** The operator is supported by automatic signal classification. The result covers a classification quality statement, a signal type statement and various signal parameters, depending on the classified signal type.
- **Demodulators and Decoders:** The signal can be processed by digital demodulators and decoders. The digital demodulator extracts an IF signal, the decoders try to extract the content (text) of the signal. Demodulators/decoders are based on MEDAV VD technology (VD = virtual devices).

Optional Work Places

The following work places are available as an option because they are not necessary in standard operation. However, they might be helpful in certain scenarios or increase the effectiveness or usability of the system:

- **Remote Control Work Place:** From the remote control work place, reconnaissance tasks can be managed and monitored from remote monitoring stations. It also allows to support the operators in their work if monitoring station is manned.
- **Operating with Panorama Work Place:** This work place is equivalent to the operator work place but is intended to be used for signal reconnaissance. Additionally it allows tuner control with quick look displays, analog demodulator control and visualization and audio output of signals and/or hand-off receivers.
- **Measuring and Analysis Work Place:** This work place is used to post-process messages: it allows to complete and finalize messages.

Depending on the work place equipment, TRS-8000 creates parts of the return message for the (sub-) task automatically. The operator may complete his message with typed notes if the signal was a clear text message, and can manually add further task relevant information. Operators can additionally demodulate, decode and convert signals from IF signal to an AF at this work place.

When the operator decides the message is complete, it is stored on the central server until the intelligence processing department picks it up.

- **Direction Finding Query Client:** the Direction finding query client is an option of the operator work place. The operator can forward direction finding jobs to a DF subsystem to find and notify the direction of emissions. If DF results from different DF stations are available, position of the emitter can be calculated and shown on a map.

A Sample System

The sample system may consist of a number of **monitoring stations** (varies from installation to installation) and a **central station**. All stations are connected over **WAN**. The central station synchronizes and monitors the system operation. The tasks are processed in the monitoring stations.

(Note that the WAN is not part of delivery. But its technical specifications affect the system performance and operation significantly.)

- LAN: a local area network connects all components of the station
- Antennas: receive the signals
- Antenna Matrix: connects the receivers of work places to the antennas. It is controlled via LAN.
- Operator Work Places: are connected to antennas via receivers and possibly via antenna matrix. Operators work at these work places to process reconnaissance tasks. Depending on the type of monitoring (Technical/Morse and Speech) the work place equipment differs. Also, they can connect to hand-off receivers.
- Supervisor Work Place: the supervisor accepts the reconnaissance tasks and distributes them to the operator work places.
- Direction finding subsystem: direction finding operator or automatic direction finding system processes direction finding tasks and notify DF results to the client.
- Printers: to print and document results etc.
- Server: the server coordinates IT processes and stores data.
- Measuring & Analysis Work Place: post-processes messages from operator work places. To do this, no antenna connection is required.
- Router/WAN: the router connects the station network to WAN, to the other stations.

Note that some of the components are optional.

Features of the Components

LAN	The required technical properties and features depend on the customer performance expectations. LAN is not part of the delivery.
Antennas, Antenna Matrix, Receivers	<p>The system is designed to process both wideband and narrowband signals. It depends on the customer requirements which type of reception equipment is used.</p> <p>The system is prepared for use of different tuners available at the system manufacturer (e.g. ComCat Tuner); however, it can also be adopted to use other tuners.</p> <p>Narrowband hand-off receivers can be used to produce the detected channels.</p>
Work Place Computers and Servers	All computers used in the system are common PCs as can be bought in commercial computer stores. The technical requirements depend on the customer performance expectations.
Direction Finding	If the direction finding option is used, the direction finding work place allows the operator to assign the direction information to the tasks and thus to the reply message.
Printers	Any common computer printer can be used as can be bought in commercial computer stores. The technical requirements depend on the customer expectations.
Router/WAN	The required technical properties and features depend on the customer performance expectations. The type of router is selected in accordance with the WAN and LAN equipment as provided by the customer. WAN infrastructure is not part of the delivery.

System Administration

The tasks are briefly described in the following:

- **System configuration:** covers setting up the PCs, operating system and network connections (routers, switches), as well as installing the software and setting up the users in the network and the TRS-8000 system. The system administrator is supported by software programs for efficiency and comfort in configuring the system.
- **Network management:** means that the system administrator monitors the network for availability and performance, and to take countermeasures if network connections are down.
- **Backup:** requires to save system and user data to tape or other persistent data carrier daily or according to a backup schedule.
- **Software maintenance:** means that the system administrator installs software updates on the server and cares for proper software configuration settings. Software automatically installs at all work places. The system administrator is also the contact person for the software manufacturer in all regards of software configuration and operation.
- **Interface control:** **means that the system administrator monitors the external interfaces over which messages, basics, tasks etc. are transmitted, e.g. to and from intelligence processing department.**

Software Architecture

Modularity	<p>The software is highly modular, platform neutral, consists of decoupled modules that fulfil specific tasks.</p> <p>The software is a set of cooperating, loosely coupled components. The decoupling concept makes the software both robust and extensible.</p>
Update Distribution	<p>Software updates are installed by the manufacturer or administrator directly on the central server. From here they can be downloaded and run by any work place.</p>
User Management	<p>User management is done by the station server. New users must subscribe to the system and authenticate anytime they want access to the system. They are assigned to groups with different privileges according to the job they are to do.</p>
Task/Message Management	<p>Central data structures of the TRS-8000 system are tasks and messages. They are exchanged between all work places of a station and carry the information of a reconnaissance task and the reconnaissance results.</p> <p>The software modules allow users to enter data for both tasks and messages. Information transfer between the work places is organized in subordinated software layers on all work places concerned.</p>
System Management	<p>System management ensures the availability of all system components, alarms and countermeasures on communication failures or system downs. Afterwards it takes care that system components can restart safely and are provided with all necessary and currently relevant information on task and system status.</p>
Step List Editor Step List Management	<p>Step lists contain sequences of tuner and processing setups which are worked through when scanning frequency ranges. They can be edited and used for different tasks. They are assigned to the tasks and are stored for later reuse. Therefore, they are accessible to different work places.</p>
DF Jobs DF Control	<p>Direction finding jobs are created by the monitoring operator and directed to the direction finding work place. Here they are processed and the result is returned to the monitoring operator, who then appends the direction finding result to the message responding to a reconnaissance task.</p> <p>This process is organized by software modules on the technical extraction work place and DF work place. They allow operators to formulate a DF job and to add the results. It corresponds to the task/message management which in turn adds the DF information to messages.</p>
Tuner Control	<p>The technical extraction work place controls the tuners, and optionally an antenna matrix. The user interface allows to adjust all required tuner parameters (depending on the type and number of tuner in use) over the user interface (GUI) and outputs audio signals, which are monitored by the monitoring operator. Underlying software modules organize the communication between computer and tuner, control of the antenna matrix and signal transfer.</p>
Signal Analysis Software	<p>Optionally, the technical extraction work place can be equipped with the MEDAV signal analysis software OC-6040. This is an extensive toolset for in-depth signal analysis.</p>
Multiple Layers	<p>The software is structured into multiple layers:</p> <ul style="list-style-type: none">• Uppermost layers are the user interfaces (GUI).• Middle layers are application logic and data management.• Below these layer reside signal processing, tuner control, system management etc.

Selected System Features

Distributed	The system is distributed over different locations and consists of different clients and servers, connected over LAN and WAN.
Operating System	The recommended operating system for all computers and full scope of service and comfort is Linux. Other operating systems are available on request.
Platforms	<p>The software is available on multiple platforms: GUIs and middle layers are programmed in Java™ combined with MEDAV Virtual Devices (VD), which are also available for different platforms.</p> <p>Note that different platforms (and operating systems) provide different levels of support for automation in configuration, installation, and system management.</p>
Fail safe concept	<p>The system is fail safe, provides uninterruptible power supply, critical hardware is redundant, software is robust to cope with most of failing hardware. There is no central database server which could block the system if it fails.</p> <p>Where possible, the design avoids locks and synchronous communication to minimize propagation of failure (in hardware and in software). This design has proven its robustness in installed systems.</p>
Connectivity	<p>Connectivity to different types of antenna and receivers (depending on the requirements, open interfaces for easy adoption to specific tuners).</p> <p>Connectivity to different types of LAN and WAN (depending on the requirements, open interfaces for easy adoption to specific network technologies).</p>
Communication	<p>The modules communicate over an adequate LAN infrastructure, however wherever possible, connectionless and asynchronously following a 1:N distribution concept, where possible. This concept is applied for WAN communication to other stations as well.</p> <p>Information interchange functions provide built-in facilities to handle temporary loss of connections, especially on WAN. Implementations are proven using cable bound and satellite WAN infrastructure.</p>
Network Management	Network management tools can be integrated optionally. It is also possible, to forward relevant events (i.e. SNMP traps) to an existing management system.
Installation/Maintenance	<p>Updates are typically held in a central software repository, from which it is</p> <ul style="list-style-type: none">• directly used or• automatically transferred to and installed on the workstations..
Remote Administration	Each work place can be administered from remote using a GUI, assumed sufficient communication bandwidth is available. Otherwise, a remote shell connection can be used instead and usual remote monitoring / management over SNMP.

Sensors

Corporate Policy

Technology

... in the products, development and in the company management is state-of-the-art and represents a top level.

Quality

... in all divisions of our company is considered as the indispensable prerequisite for a risk-free and successful cooperation with our customers and business partners.

Position in the market

... is affected by extensive experience gained from signal and information processing. We are prepared best to face competition.

Product and engineering spectrum

... are comprehensive, complete and tailored to meet all requirements. As a single source supplier of solutions, we offer standard devices, systems and services.

Employees

... form the roots of the company and render the services necessary for maintaining and expanding the technical basis and a trustful and fair cooperation.

Growth

... on a stable technical and economical basis at home and abroad is our declared long-term goal.

Trust and fairness

... vis-à-vis our business partners and within the company are the basis of our business.

Compliance

... with excessive sensibility and compliance with German and international export regulations we act on a worldwide basis.

Signals

Classification

Content

Information

Intelligence