

go2DECODE

go2signals



**MANUAL TECHNICAL  
SIGNAL ANALYSIS  
– DECODER DEVELOPMENT**



go2DECODE

**GO2SIGNALS IS AN INNOVATIVE SOFTWARE PACKAGE, DESIGNED TO MEET TODAY'S TACTICAL AND STRATEGIC REQUIREMENTS IN THE FIELDS OF RADIO-MONITORING, COMMUNICATIONS INTELLIGENCE AND SIGNALS ANALYSIS AND EXPLOITATION.**

#### **GO2SIGNALS – THE ONE FOR ALL RADIO MONITORING TASKS**

The go2signals toolset consists of a collection of complementary software applications to search, monitor, process and analyze radio communication from SLF up to SHF frequency range, specialized on HF and V/UHF signals. Its open design concept allows the users to adapt, tailor and automate their monitoring tasks, improving the quality of results, managing the increasing density of signals and sub-bands in the RF spectrum, and 'staying current' with new requirements.

Employing wideband parallel-processing techniques, our go2signals monitoring application offers powerful capabilities for HF-V/UHF voice / data-signals interception, monitoring and recording even on small sized COTS hardware. It includes automatic detection, modulation classification, modem recognition, deep context decoding, sensor controlling and a database to collect all the results.

To improve quality of automated results use go2signals toolsets for signal analysis and decoder development, to analyze and adapt demodulator parameters, to develop new customer decoders and protocols and to 'fine-tune' signals monitoring tasks. Even forensic analysis of demodulated data signals at the bitstream level are possible.

In this way, the User's knowledge and experience are incorporated into all signals exploitation objectives based on our range of go2signals.

## **IDENTIFY UNKNOWN SIGNALS**

The increasing density of signals, the growing complexity and the use of modified standard modems are posing ever-increasing challenges. To keep a handle on these challenges of signal monitoring and interception, it is necessary to do both: processing known signals / Signals of interest job-based and automatically and concentrate on the analysis and decoding of new, unidentified emissions.

go2DECODE enables the user to analyse and determine technical parameters and settings of new, unidentified signals and unknown modems. Use this information, to adapt and develop new, customer decoders.

## **KEEP YOUR MONITORING SOLUTION UP-TO-DATE**

Integrate these new created protocols / decoders into the knowledge base of your monitoring solution and new and previously unidentified signals can be recognized and processed automatically. This keeps your system up-to-date with the RF environment and futures automatic processing needs.

## **IMPROVE QUALITY OF YOUR MONITORING RESULTS**

go2DECODE is the analysis tool to determine technical parameters and settings of new, unidentified signals and unknown modems, of unknown or new transmission methods, to adapt or develop decoders in order to incorporate them into an existing go2MONITORING solution.

Therefore go2DECODE provides various displays and measurement functions as well as a complete decoder development environment including an easy-to-learn programming language.

Using go2DECODE in addition to your go2MONITORING Solution - improve results, make your system adaptive and stay current with your requirements.



## **FUNCTIONS OVERVIEW**

- ✓ **Comprehensive toolsets enabling forensic analysis of signals' external parameters and internal content**
- ✓ **Displays for monitoring and manual analysis of unidentified signals**
- ✓ **Automatic measurement and continuous tracking of signal characteristics**
- ✓ **Wide range of universal demodulators and standard decoders**
- ✓ **Automatic signal processing of radio data and voice signals, decoding, recording**
- ✓ **Voice detection and demodulation**
- ✓ **Signal decoding from digital or analogue receivers via streaming, audio, files or internal signal buffer**
- ✓ **Creation and modification of decoders with Decoder Description Language (DDL/pyDDL)**
- ✓ **Signal acquisition from digital or analogue receivers via LAN / USB or audio input**
- ✓ **IF/IQ and AF-recordings**
- ✓ **Integrated receiver control**
- ✓ **Easy integration through TCP/IP-based data interchange via LAN**

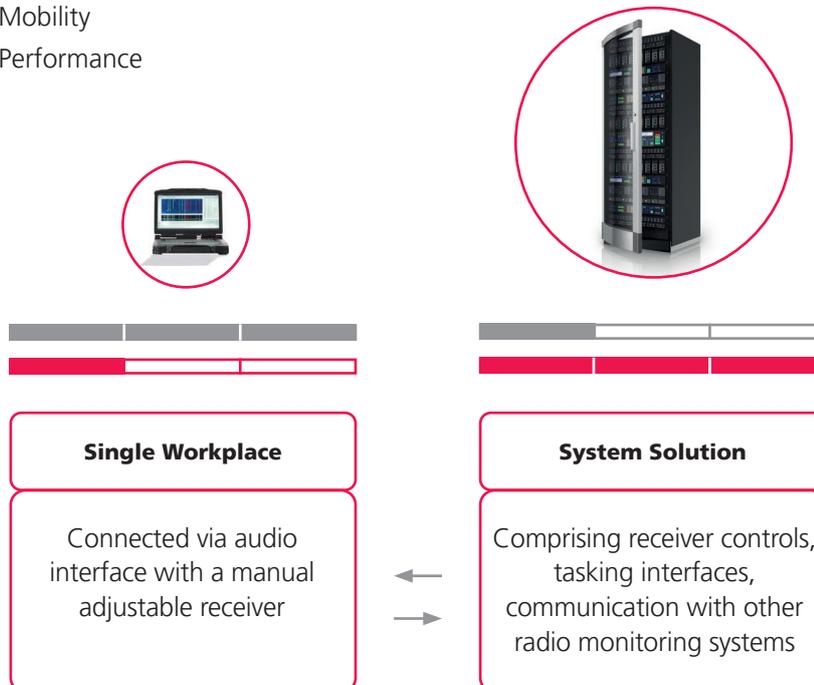
## ALTHOUGH GO2DECODE IS OPTIMIZED FOR STANDALONE APPLICATIONS, IT IS ABLE TO INTERACT WITH OTHER RADIO MONITORING SOLUTIONS BASED ON GO2MONITOR.

### SINGLE WORKPLACE AND SYSTEM SOLUTIONS

Open interfaces allow for an easy TCP/IP based communication. The field of application ranges from a single go2DECODE connected via the audio interface with a manual adjustable receiver to a system solution, comprising receiver controls, tasking interfaces, communication with other radio monitoring systems and a central database.

■ Mobility

■ Performance



# USE CASES

## MANUAL AND AUTOMATIC SIGNAL MONITORING

Working in changing signal scenarios needs a decoder with automatic modem recognition to lossless process every signal of interest. Therefore, go2DECODE checks the input signal for the predefined modem types in the steps:

- ✓ **detection**
- ✓ **automatic recognition**
- ✓ **demodulation and decoding**

Signal characteristics (e. g. centre frequency and symbol rate) are determined and displayed. Decoded text will be displayed as plain text or as a formatted XML-stream. go2DECODE buffers the incoming signal continuously. Buffering allows lossless demodulation and decoding in time respect.

Because of this multi-level process a modulation classification, modem recognition and a complete production can be realised with go2DECODE. Thus, even incomplete processing steps lead to partial results. Quality criterion's of all results are calculated and displayed. For best results, code aided and soft-decision demodulators are implemented in the decoders if supported by the transmission protocol.

## MANUAL ANALYSIS OF UNIDENTIFIED SIGNALS

New and unidentified signals can be automatically or manually recorded. These recordings are used for signals analysis, measuring modulation and coding parameters. A comprehensive set of built-in analysis tools with special modulation and code analysis features supports the new or experienced operator.

Example analysis tools include:

- 📡 **Spectrogram and spectrum displays for FFT analysis and baud rate measurement**
- 📡 **Autocorrelation display to highlight signal repetitions**
- 📡 **Constellation display for phase modulation analysis**
- 📡 **Analysis display to measure amplitude, frequency and phase behavior**
- 📡 **Raster ('Hell') display for coding analysis**
- 📡 **Extensive set of cursor functions to measure harmonics**

## ADAPTATION OF DEMODULATOR AND DECODER LIBRARY

go2DECODE differs to other analysis tools, enabling the operator to parametrize its set of universal demodulators. The analysis functions can not only be used to analyse the input signals, they can also be used to monitor the internal processing of the demodulator.

The operator is able to set up a demodulator on a new signal, parametrize the demodulator and control and optimize the demodulation process. The bits can be stored and transferred for extended stream analysis to other analysis tools (see go2ANALYSE) or used as input data for the internal decoder.

With the advanced Decoder Description Language (DDL/pyDDL), new decoders can be created and existing decoders can be modified. Therefore, we deliver go2DECODE with the DDL/pyDDL source code for many of our decoders. The delivered DDL/pyDDL source code can be used as a template or adapted to your needs with the integrated editor. Editor and Debugger (Spyder) are part of the go2DECODE Professional version. Information about the demodulator settings and decoders can be stored as a signal / protocol-specific Modem Description File (MDF), extending the protocol library (also in go2MONITOR).

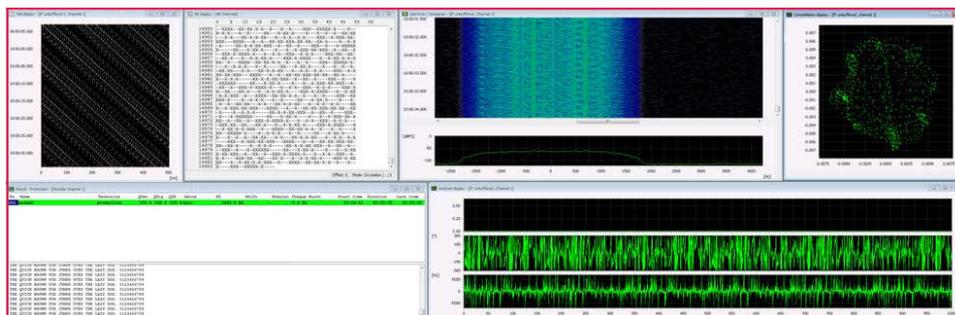
## EXTENDING THE LIST OF MODEMS FOR MANUAL AND AUTOMATIC MONITORING

Just include your own generated protocols in the modem list used for signal monitoring. Thus, new and previously unidentified signals can be recognized and processed automatically. Modem Description Files can be exported for use in go2MONITOR.

In addition, go2DECODE is the perfect companion for go2MONITOR if signal analysis functions are required.

The complementary go2ANALYSE software application offers additional functions for low level and forensic code inspection and bitstream analysis.

### Main window of go2DECODE



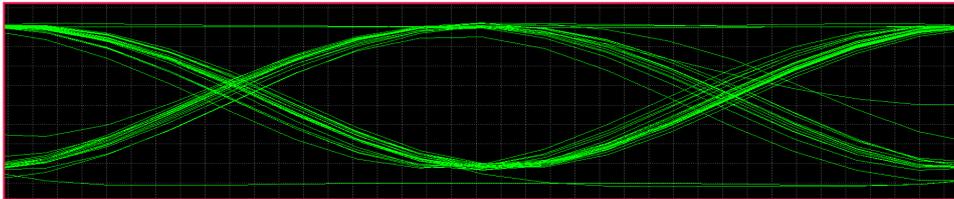
# FUNCTIONS: SIGNALS ANALYSIS

## MANUAL SIGNALS ANALYSIS

Precise measurements can be achieved with the displays provided by go2DECODE. With spectrum / spectrogram, spectrum, autocorrelation display, constellation display, time domain / eye-pattern display all the necessary tools needed to determine the signal characteristics are available.

The analysis display allows for the simultaneous interpretation of magnitude, frequency and phase of a signal to determine the utilized modulation. The Hell (raster) display and the bit display show information about the signal's coding and binary structure. In each display, double, cross-hair and harmonic cursors are offered. These powerful functions provide in-depth analysis, required to setup new demodulators and decoders applied for automatic decoding.

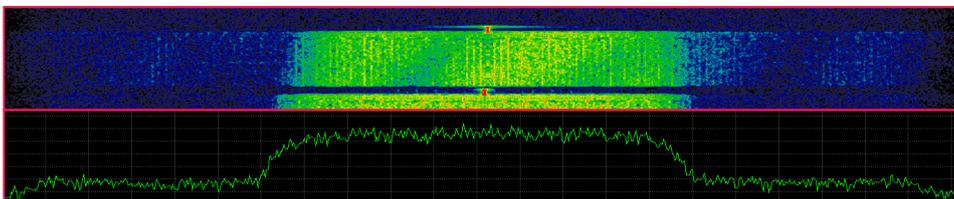
### Eye pattern display



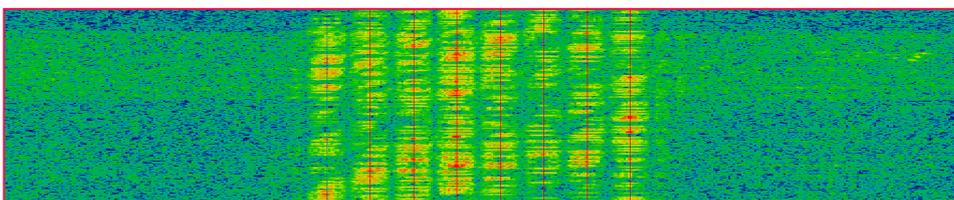
### Analysis display



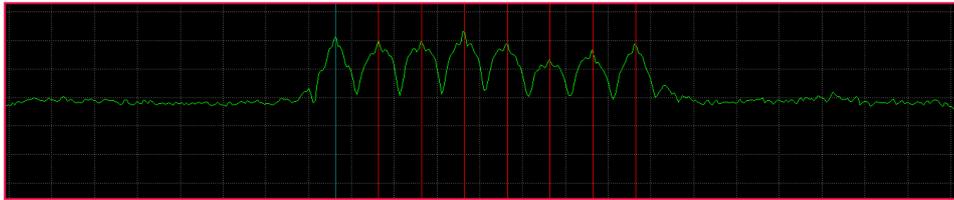
### Spectrum / Sonagram display



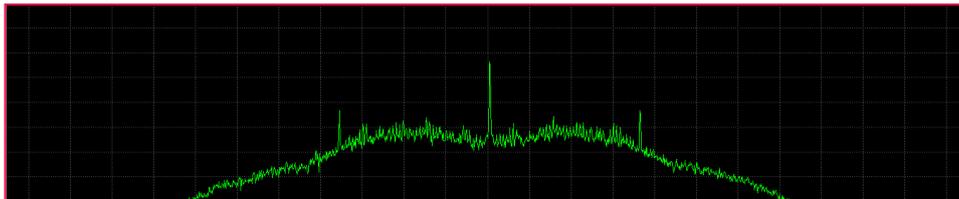
### Spectrogram with variable time resolution and harmonic cursors



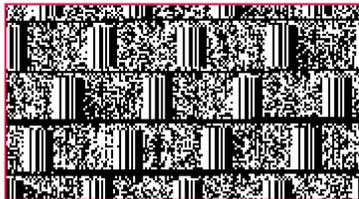
**Spectrum with variable frequency resolution Time ('oscilloscope') display**



**Spectrum over squared input signal**



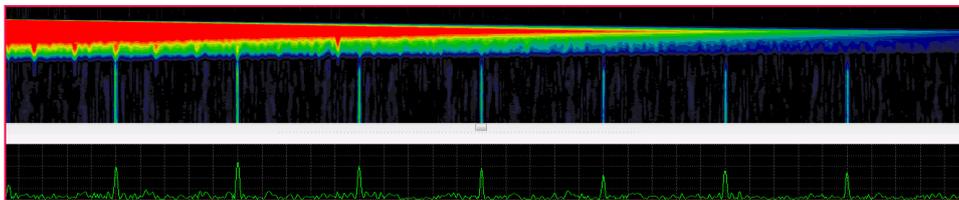
**Bit display**



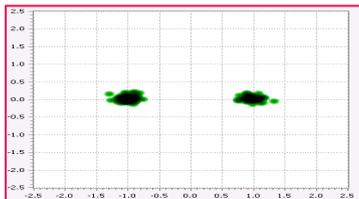
**Hell display**



**Signal autocorrelation**



**Constellation display**



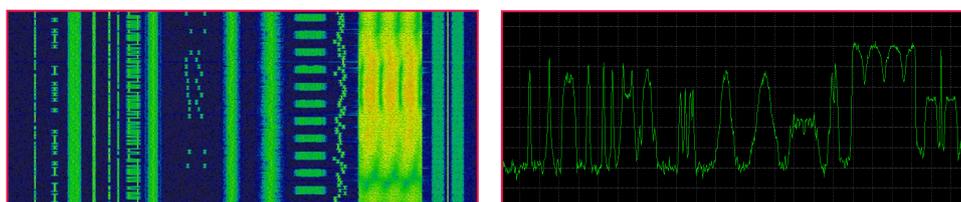
## **FUNCTIONS FOR EASY OPERATION**

- +** In each display double, cross-hair or harmonic cursors are available
- +** Search frequency and bandwidth are shown as well as the nominal frequency in addition to the live signal currently being monitored in the spectrum / spectrogram display
- +** The absolute signal time is shown and switching between line and dot drawing mode is easily possible
- +** Easy adjustment of the zoom factor with „Ctrl + mouse wheel“ in the results and the bit display

## SIGNAL GENERATOR

go2DECODE contains a software tool to generate modulated signals. It's the perfect capability for operator training; simulation of signal and operational scenarios, comparison of signals when analysing unidentified signals, and testing of hardware and software. The signal generator produces a wide range of modulation types. Modulator parameters such as frequency, symbol rate, pulse shape and burst length can be changed to situation-specific values. It is possible to modify the coding scheme and to edit the text or bit-pattern used. Moreover, it serves to generate complex signal scenarios with many different signals in parallel and channel simulation which can be stored and reloaded.

### Signal Generator



## FUNCTIONS: DECODER DEVELOPMENT

### DECODER DESCRIPTION LANGUAGE (DDL/PYDDL)

For many reasons the users might wish to define and create their own decoders or modify the integrated standard decoders. The continually evolving Decoder Description Language (DDL/pyDDL) - provides the perfect toolkit for this task.

DDL offers many new features by using Python language as base (pyDDL) for future development. Decoder development takes place with the huge set of commands and libraries inherited from Python and the additional specialized set of more than 100 specialized commands e.g. for pre-processing, searching, reading, transformation and output formatting. The set of commands is designed not only for basic detecting and synchronising tasks, but also for complex channel decoding techniques.

All factory-supplied decoders have been created using DDL and pyDDL in future. Operators can use the supplied sources as a template for their own decoder development.

The starting point is a demodulated bitstream produced with the free parametrized demodulators inside. DDL/pyDDL enables analysis and processing of these bitstreams to ensure that the decoded message content and his metadata are successfully extracted. This way, even modern, complex channel decoding techniques are applied in only a few steps.

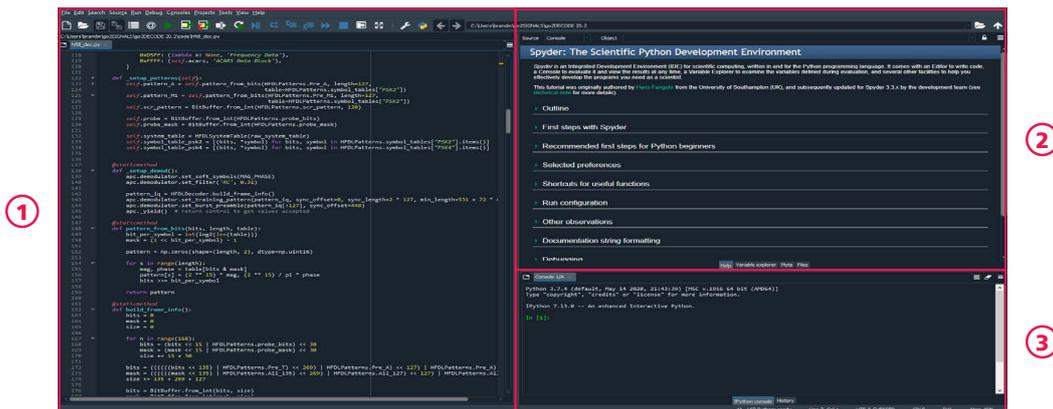
## DECODER DEVELOPMENT TOOLS

Decoders are preferably created and tested using specialised tools. This way, decoder developers obtain the best possible insight into the entire modem function flow. go2DECODE's pyDDL-based decoder development tools consist of Spyder as integrated editor and debugger.

Spyder is used to create and modify the pyDDL scripting source code. The editor offers automatic command completion and context sensitive help. Correct commands, functions and keywords are highlighted in color for visual checks. In the case of coding errors, Python scripting interpreter logs detailed error messages to help debugging code.

In addition, the integrated debugger is used to verify the executable decoders. The application enables analysis of the decoding procedure in detail. The large set of functionalities like stepping line-by-line, setting breakpoints, checking values of variables a.m. meet customers' expectations on a modern development platform.

### Decoder Development using Spyder



- 1 Editor
- 2 Help Functions / Decoder Output
- 3 Debugger Control

# FUNCTIONS: SIGNAL PROCESSING

## PROCESSING OF VOICE SIGNALS

A powerful voice (AM, FM, SSB) detection module is integrated. The voice processing algorithms of go2DECODE are insensitive to wideband interference caused by noise phenomena at the air-interface (e.g. ionospheric noise).

The sensitivity level itself can be parametrized. In addition to the decision “voice yes or no” the module determines the values for nominal frequency, voice pitch and modulation type. The voice transmission can be demodulated and stored in audio files for playback / monitoring and further processing.

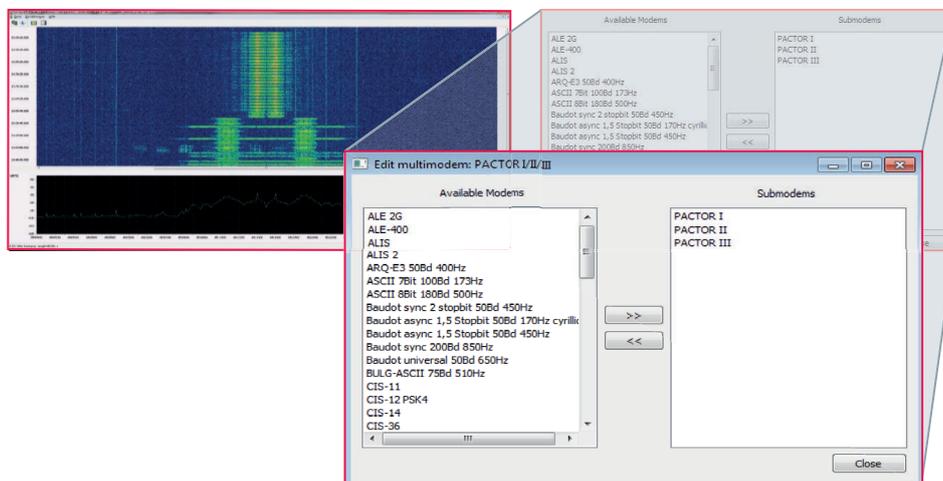
## RECORDING

In addition to the live demodulation and decoding of Signals Of Interest, the recording of signals is an important task to enable offline analysis. Recorded signals are the basis for manual technical analysis of unidentified signals and for archiving the Signals Of Interest. go2DECODE enables recording of both IF/IQ and demodulated AF.

The recordings are started and stopped either via automatic triggers or manually by the operator. The triggers supported by go2DECODE are configurable squelch, signal detection, modem recognition and voice detection. go2DECODE also allows recording of the demodulated bitstream to a txt-file or a go2DECODE format (including metadata such as the quality of each bit).

## HANDLING OF ADAPTIVE PROTOCOLS

The multimodem feature describes and combines multiple modes used within the modern protocols of one multimodem (e.g. ‘fallback’ modes). Thereby adaptive radio signals using different modes can be produced as one signal without loss. The user can define their own multimodems or edit existing multimodems in an intuitive way.



# TECHNICAL SPECIFICATIONS

## SPECIFICATIONS OVERVIEW

<b>Data acquisition</b>	<ul style="list-style-type: none"> <li>• Digital IF stream (complex baseband I/Q); Soundcard (real or complex);</li> <li>• Digital AF (WAV 8, 16, 32 Bit); Others on request</li> </ul>
<b>Localization</b>	English or German; Others on request
<b>Documentation</b>	PDF User manual / PDF Online-Help
<b>Recommended PC Hardware</b>	<ul style="list-style-type: none"> <li>• Notebook or Desktop; CPU: Intel i5, min. 2 GHz;</li> <li>• Memory: <math>\geq 2</math> GByte RAM, HDD: <math>\geq 10</math> GB,</li> <li>• Screen Resolution min. 1280 x 1024 Pixel,</li> <li>• Soundcard for analogue IF input, 1 GBit/s Ethernet for digital IF input</li> </ul>
<b>OS</b>	<ul style="list-style-type: none"> <li>• Windows 7 SP1 (with Microsoft Windows patches KB2999226 and KB2533623, deprecated)/10/11 de/en, 64 bit</li> <li>• Linux CentOS 7 (7.5 or higher, 7.5 is recommended) and RHEL 8 (8.4 recommended) 64 Bit</li> </ul>
<b>ISO 9001:2015</b>	Company is certified (not only hardware)
<b>Licence</b>	<ul style="list-style-type: none"> <li>• USB-Dongle (Codemeter)</li> <li>• License sharing with license server</li> </ul> <p>The AMBE+2™ voice coding Technology embodied in this product is protected by intellectual property rights including patent rights, copyrights and trade secrets of Digital Voice Systems, Inc. This voice coding Technology is licensed solely for use within this Licensed Product. The user of this Technology is explicitly prohibited from attempting to extract, remove, decompile, reverse engineer, or disassemble the object code, or in any other way convert the Object Code into a human-readable form. US Patent Nos. #8,595,002, #8,359,197, #8,315,860, #8,200,497, #7,970,606, #6,912,495 B2, #6,199,037</p>

## FEATURES

<b>Software Feature</b>	<b>Remarks</b>
<b>Alphabets</b>	Can be added to the decoder source code, free configurable (requires go2DECODE Professional)
<b>Decoders</b>	<p>Our list of standard, military and PMR decoders is subject to continuous development. See the current list of available decoders on our website: <a href="http://www.procitec.de">www.procitec.de</a>.</p> <ol style="list-style-type: none"> <li>1. MIL and PMR decoders may need an End-User-Certificate (depending on the country of the user)</li> <li>2. Automatic sideband detection can be achieved via two modems set to inverse sidebands</li> <li>3. A gap between message bursts and acknowledge burst must be detectable</li> <li>4. Separation of slow selcall types cannot be guaranteed</li> <li>5. Slow multitone modems are recommended to operate with fixed nominal frequency</li> </ol>

The performance of our software products depends on the hardware used.

Technical parameters can differ under real operational conditions. Specifications subject to change.

# TECHNICAL SPECIFICATIONS

## FEATURES

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<b>Voice detection, demodulation, recording</b>	<ul style="list-style-type: none"> <li>• Modulation types: AM, FM, USB, LSB</li> <li>• Detection: voice yes / no</li> <li>• Nominal frequency</li> <li>• Voice Pitch</li> <li>• Automatic audio demodulation and recording</li> </ul>																																																						
<b>Demodulators</b>	<table border="1"> <tbody> <tr> <td>• Voice (AM/A3E; J3E (USB, LSB); FM/F3E)</td> <td>• Clover 2500</td> </tr> <tr> <td>• Morse</td> <td>• Coquelet</td> </tr> <tr> <td>• F6/F7B</td> <td>• MT63</td> </tr> <tr> <td>• ASK 2 (OOK), 4, 8</td> <td>• Pactor II</td> </tr> <tr> <td>• FSK 2, 4, 8 disc.</td> <td>• Pactor III</td> </tr> <tr> <td>• FSK 2 matched</td> <td>• Pactor 4</td> </tr> <tr> <td>• FSK 2,3 auto shift</td> <td>• Robust Packet</td> </tr> <tr> <td>• Multitone (FSK<sub>n</sub>, single or simultaneous tones)</td> <td>• THROB/THROBX</td> </tr> <tr> <td>• MCFSK 2</td> <td>• Wideband HF* (MIL110 App.D)</td> </tr> <tr> <td>• (G)MSK</td> <td>• QAM<sub>n</sub> var:</td> </tr> <tr> <td>• TFM3, 5</td> <td>- APSK16_dvbs2</td> </tr> <tr> <td>• DPSK 2, 4, 8,16 A/B</td> <td>- ASK2PSK2 abs/diff (ASK 4)</td> </tr> <tr> <td>• PSK 2, 4, 8,16 A/B</td> <td>- ASK2PSK4 abs/diff</td> </tr> <tr> <td>• PSK data aided</td> <td>- ASK2PSK8 abs/diff</td> </tr> <tr> <td>• MDPSK2, 4, 8, 16 A/B</td> <td>- ASK2PSK16 diff</td> </tr> <tr> <td>• MPSK2, 4, 8, 16 A/B</td> <td>- QAM 8</td> </tr> <tr> <td>• OQPSK</td> <td>- QAM 16 circle/square</td> </tr> <tr> <td>• QAM<sub>n</sub> 16, 32, 36, 64, 128, 144, 256</td> <td>- QAM 16 v17 abs/diff</td> </tr> <tr> <td>• OFDM</td> <td>- QAM 16 v22 abs/diff</td> </tr> <tr> <td>• CHIRP</td> <td>- QAM 32 circle</td> </tr> <tr> <td>• MultiModem</td> <td>- QAM 64 circle/square</td> </tr> <tr> <td>• Analogue Selcal</td> <td>- QAM 256 square</td> </tr> <tr> <td>• Clover II</td> <td>• Automatic frequency, amplitude and symbol rate control</td> </tr> <tr> <td>• Clover 2000</td> <td>• Fast equalizer using known training sequences (via DDL/pyDDL)</td> </tr> <tr> <td>• F1A</td> <td>• Primary demodulation USB/LSB/AM/FM</td> </tr> <tr> <td>• Link11*</td> <td>• Automatic burst synchronization</td> </tr> <tr> <td></td> <td>* only with Option Military Decoder Package</td> </tr> </tbody> </table>	• Voice (AM/A3E; J3E (USB, LSB); FM/F3E)	• Clover 2500	• Morse	• Coquelet	• F6/F7B	• MT63	• ASK 2 (OOK), 4, 8	• Pactor II	• FSK 2, 4, 8 disc.	• Pactor III	• FSK 2 matched	• Pactor 4	• FSK 2,3 auto shift	• Robust Packet	• Multitone (FSK <sub>n</sub> , single or simultaneous tones)	• THROB/THROBX	• MCFSK 2	• Wideband HF* (MIL110 App.D)	• (G)MSK	• QAM <sub>n</sub> var:	• TFM3, 5	- APSK16_dvbs2	• DPSK 2, 4, 8,16 A/B	- ASK2PSK2 abs/diff (ASK 4)	• PSK 2, 4, 8,16 A/B	- ASK2PSK4 abs/diff	• PSK data aided	- ASK2PSK8 abs/diff	• MDPSK2, 4, 8, 16 A/B	- ASK2PSK16 diff	• MPSK2, 4, 8, 16 A/B	- QAM 8	• OQPSK	- QAM 16 circle/square	• QAM <sub>n</sub> 16, 32, 36, 64, 128, 144, 256	- QAM 16 v17 abs/diff	• OFDM	- QAM 16 v22 abs/diff	• CHIRP	- QAM 32 circle	• MultiModem	- QAM 64 circle/square	• Analogue Selcal	- QAM 256 square	• Clover II	• Automatic frequency, amplitude and symbol rate control	• Clover 2000	• Fast equalizer using known training sequences (via DDL/pyDDL)	• F1A	• Primary demodulation USB/LSB/AM/FM	• Link11*	• Automatic burst synchronization		* only with Option Military Decoder Package
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<b>GUI</b>	<ul style="list-style-type: none"> <li>• Easy and intuitive to operate</li> <li>• Input spectrogram with live audio</li> <li>• Manual and automatic demodulator and decoder control</li> <li>• Different analysis displays for manual signal analysis</li> <li>• Specialized signals analysis cursor measurement functions</li> <li>• Modem editor with demodulator and decoder settings</li> <li>• Decoder editor and debugger (DDL/pyDDL, Option Professional)</li> </ul>																																																						
<b>Input Files (DANA)</b>	<ul style="list-style-type: none"> <li>• Digital IF (complex baseband I/Q 32 Bit), Sampling rate ≤ 10 MHz (note: functionality may be limited for sampling rates higher than 2 MHz)</li> <li>• Playback of standard wav files.</li> <li>• Digital IF/AF (real / complex WAV 8, 16, 32 Bit)</li> <li>• Playback of Perseus and WiNRADiO WAV recordings with correct frequency display</li> </ul>																																																						

## FEATURES

Software Feature	Remarks	Remarks
<b>Input Audio (DANA)</b>	<ul style="list-style-type: none"> <li>• Playlist (files)</li> <li>• Loop mode</li> <li>• Complex IQ /</li> <li>• Audio files</li> <li>• Remove DC</li> <li>• Filtering</li> <li>• Mirror</li> </ul>	<ul style="list-style-type: none"> <li>• FM demodulation</li> <li>• Time source (File / System clock)</li> <li>• Sample rate converter</li> <li>• Centre frequency tuning</li> <li>• Streaming TCP/IP</li> <li>• Configurable replay speed</li> </ul>
<b>Input TCP/IP Streaming</b>	<ul style="list-style-type: none"> <li>• Up to 10 MHz sampling rate (note: functionality may be limited for sampling rates higher than 2 MHz)</li> <li>• Generic PROCITEC / PLATH format</li> <li>• VITA 49</li> <li>• PXGF</li> </ul>	
<b>Signal recordings</b>	<ul style="list-style-type: none"> <li>• Types: IF/AF</li> <li>• Start / Stop               <ul style="list-style-type: none"> <li>- Manual by operator</li> <li>- Automatic by trigger</li> </ul> </li> <li>• Trigger types               <ul style="list-style-type: none"> <li>- Configurable squelch level</li> <li>- Signal detected</li> <li>- Transmission method recognized</li> <li>- Transmission method unknown</li> <li>- Voice / Morse detected</li> </ul> </li> <li>• File formats: WAV</li> </ul>	

## FEATURES

Software Feature	Remarks	Windows supported	Linux supported
<b>Compatible receivers</b>	• AirSpy	X	
	• CommsAudit CA7851	X	X
	• Grintek GRX Lan	X	
	• IZT R3xxx series	X	X
	• IZT R4000 (SignalSuite)	X	X
	• Microtelecom PERSEUS	X	
	• narda® NRA-3000 RX	X	X
	• narda® NRA-6000 RX	X	X
	• narda® IDA 2	X	X
	• narda® SignalShark® 3310	X	X
	• PLATH SIR 5110 / 5115	X	X
	• R&S EB 500	X	X
	• R&S EB 510	X	X
• R&S EM100 / PR100	X	X	

# TECHNICAL SPECIFICATIONS

## FEATURES

Software Feature	Remarks	Windows supported	Linux supported
<b>Compatible receivers</b>	<ul style="list-style-type: none"> <li>• RFSPACE NetSDR</li> </ul>	X	X
	<ul style="list-style-type: none"> <li>• RFSPACE SDR-14</li> </ul>	X	
	<ul style="list-style-type: none"> <li>• RTLSDR/Noxon USB-sticks</li> </ul>	X	
	<ul style="list-style-type: none"> <li>• SDRplay RSP1 &amp; RSP2</li> </ul>	X	
	<ul style="list-style-type: none"> <li>• SignalHound BB60C</li> </ul>	X	X
	<ul style="list-style-type: none"> <li>• SignalHound SM200 A/B</li> </ul>	X	X
	<ul style="list-style-type: none"> <li>• ThinkRF R5500-408</li> </ul>	X	X
	<ul style="list-style-type: none"> <li>• ThinkRF R5500-427</li> </ul>	X	X
	<ul style="list-style-type: none"> <li>• ThinkRF WSA5000-408</li> </ul>	X	X
	<ul style="list-style-type: none"> <li>• ThinkRF WSA5000-427</li> </ul>	X	X
	<ul style="list-style-type: none"> <li>• USRP X310</li> </ul>	X	X
	<ul style="list-style-type: none"> <li>• WiNRADiO G31DDC/G33DDC/ G35DDC/G39DDC</li> </ul>	X	
	<ul style="list-style-type: none"> <li>• Generic VITA 49 receiver support</li> </ul>	X	X
<ul style="list-style-type: none"> <li>• Other generic "Winrad ExtIO" supported receivers</li> </ul>	X		
<b>Output</b>	<ul style="list-style-type: none"> <li>• Decoding results</li> <li>• TXT-File with decoded text</li> <li>• XML-File with decoded text and metadata</li> <li>• Signal recordings</li> <li>• Voice recordings</li> <li>• Bitstream *.rec files (bits and quality of each bit)</li> <li>• Bitstream *.txt files (bits)</li> </ul>		
<b>Sonagram Viewer (SoVi)</b>	Standalone application for spectrum / spectrogram display		
<b>ResultViewer (PNO)</b>	Display of: Decoder output, demodulated audio files (CW, TETRA etc.), text output (ALE, HF DL, etc.), binary files		
<b>Signal Generator (SOMO)</b>	For standard test signals. Requires go2DECODE-Professional; Detailed description see page 19		
<b>Decoder Development</b>	<ul style="list-style-type: none"> <li>• Modification of standard decoders</li> <li>• Definition of new decoders</li> <li>• Integration of existing decoders, requires go2DECODE-Professional; Detailed description see page 18</li> </ul>		
<b>Soundcard Interface (DANA)</b>	<ul style="list-style-type: none"> <li>• Analogue input</li> <li>• WiNRADiO VSC</li> <li>• Virtual-Audio-Cable (VAC) etc.</li> </ul>		

## FEATURES

Software Feature	Remarks
<b>Third party decoder</b>	<ul style="list-style-type: none"> <li>• Interface to the DDC channel output</li> <li>• Interface to the bitstream output</li> <li>• Streaming and control interface with DDL/pyDDL</li> </ul>
<b>Training</b>	<ul style="list-style-type: none"> <li>• Very short training period</li> <li>• Same technology as in large decoding systems</li> <li>• go2DECODE Training Courses available:               <ul style="list-style-type: none"> <li>- Standard Operator Training</li> <li>- DDL/PYDDL Training</li> <li>- go2DECODE in Tactical Operations Training</li> </ul> </li> </ul> Detailed description see page 20-22.

## ANALYSIS FUNCTIONS

Analysis	Item
<b>Displays</b>	<ul style="list-style-type: none"> <li>• Spectrum</li> <li>• Spectrogram / Sonagram</li> <li>• Autocorrelation</li> <li>• I/Q Constellation</li> <li>• Eye pattern</li> <li>• Time domain (oscilloscope) with additional histogram</li> <li>• Analysis (magnitude, frequency and phase) with additional histogram</li> <li>• Hell</li> <li>• Bit</li> </ul>
<b>Signal squaring</b>	<ul style="list-style-type: none"> <li>• Squaring: 0, 1, 2, 3</li> </ul>
<b>Windowing</b>	<ul style="list-style-type: none"> <li>• Rectangle</li> <li>• Hanning</li> <li>• Hamming</li> <li>• Kaiser</li> <li>• Flat Top</li> <li>• Blackman</li> </ul>
<b>Cursors</b>	<ul style="list-style-type: none"> <li>• Harmonic</li> <li>• Crosshair</li> <li>• 2 cursor modes</li> </ul>
<b>Centre frequency</b>	Adjustable
<b>Operation modes</b>	Online / offline

# TECHNICAL SPECIFICATIONS

## DECODER DEVELOPMENT (INCLUDED ONLY IN GO2DECODE PROFESSIONAL)

Decoder Developments	Item
<b>Basic functions</b>	<ul style="list-style-type: none"><li>• Modification of standard decoders</li><li>• Definition of new decoders</li><li>• Integration of existing decoders</li></ul>
<b>Function library</b>	<ul style="list-style-type: none"><li>• Preprocessing</li><li>• Symbol conversions</li><li>• Descrambling procedures</li><li>• Channel selections</li><li>• Pattern search</li><li>• Burst detection</li><li>• Forward/backward time jumps</li><li>• Deinterleaving</li><li>• Check and correction procedures: CRC, Hamming, Viterbi, BCH, Reed-Solomon</li><li>• Elementary arithmetic and bit manipulations</li><li>• Table handling</li><li>• Various output formats, alphabets, channels</li><li>• Control of demodulation and decoding</li><li>• Setting of demodulator parameters</li><li>• Selected voice codecs</li><li>• Branches and sub-routines</li><li>• Soft decision</li><li>• Expandable with third party Python modules or C libraries (pyDDL only)</li></ul>
<b>Decoder Editor Spyder</b>	<ul style="list-style-type: none"><li>• Automatic command completion</li><li>• Content related help</li><li>• Syntax highlighting</li></ul>
<b>Debugger Spyder</b>	<ul style="list-style-type: none"><li>• Debugging<ul style="list-style-type: none"><li>- Breakpoints on lines of code</li><li>- Single-step mode for lines of code</li><li>- Display of variable contents in various formats and displays</li><li>- Editing of variable contents</li><li>- Display of all input data packages</li><li>- Display of internal data buffer and current read position</li></ul></li><li>• Advanced analysis of recognition, demodulation and decoding<ul style="list-style-type: none"><li>- Breakpoints in several decoders for one modem list</li><li>- Comparison of the decoder behaviour in search phase / decoding phase</li><li>- Monitoring the current demodulator state</li></ul></li></ul>

## SOMO SIGNAL GENERATOR (INCLUDED ONLY IN GO2DECODE PROFESSIONAL)

Somo Signal Generator	Item
<b>Modulation generation</b>	<ul style="list-style-type: none"> <li>• Single and multichannel, continuous and short-duration / burst signals</li> <li>• Waveform and digital modulation (using ITU emission designators):               <ul style="list-style-type: none"> <li>- ASK<sub>n</sub></li> <li>- PSK<sub>n</sub> (single and multi channel)</li> <li>- QAM<sub>n</sub> (single and multi channel)</li> <li>- ASK<sub>n</sub>PSK<sub>m</sub> (single and multi channel)</li> <li>- NCPFSK<sub>n</sub> (Non-Coherent-Phase FSK)</li> <li>- FSK<sub>n</sub> (single and multi channel)</li> <li>- MSK (single and multi channel)</li> <li>- GMSK (single and multi channel)</li> <li>- OFDM</li> <li>- F7B (FM with 2 or more digital channels)</li> <li>- TFM 3/5 (Tamed Frequency Modulation)</li> <li>- Morse</li> <li>- Sine</li> <li>- Rectangle</li> <li>- Sawtooth</li> <li>- Triangular</li> </ul> </li> <li>• Analogue modulation:               <ul style="list-style-type: none"> <li>- AM, SSB (LSB / USB), FM</li> </ul> </li> <li>• Variable modulation parameters:               <ul style="list-style-type: none"> <li>- Attenuation</li> <li>- Center frequency</li> <li>- Baud rate</li> <li>- Pulse shapes: RC pulse, RC/RRC spectrum, Gauss pulse</li> <li>- Short-duration / burst parameters</li> </ul> </li> </ul>
<b>Coding generation</b>	<ul style="list-style-type: none"> <li>• Binary, Baudot, ASCII, HC ARQ, ITA2</li> <li>• Differential / absolute coding</li> <li>• Convolutional encoding / Viterbi</li> <li>• CCITT standards V.17 ... V.33</li> <li>• Variable bitstream, bit order, parity</li> <li>• Various scrambling algorithms and recursive sequences</li> </ul>
<b>Channel simulation</b>	<ul style="list-style-type: none"> <li>• AWGN</li> <li>• Multipath propagation: Watterson (ITU) and enhanced ITS model</li> </ul>
<b>Output</b>	Soundcard / Wav Files / network stream

# ORDER GUIDE

The products are configurable. The software delivered will be configured as stated in the order confirmation.

Software go2DECODE	Automatic processing	Analysis functions	Decoder development	SOMO Signal generator	Recording / replay	Standard set of decoders	Set of military decoders <sup>1</sup>	Set of PMR/SAT decoders <sup>2</sup>
<b>Light</b>	X				X	X	O	O
<b>Standard</b>	X	X			X	X	O	O
<b>Professional</b>	X	X	X	X	X	X	O	O

**X** = included    **O** = as option available

### Export conditions:

- ① In case of an export from the Federal Republic of Germany an export permission must be granted by the German authorities. Enduser certificate is required.
- ② In case of an export from the European Union an export permission must be granted by the German authorities. Enduser certificate is required.

# TRAINING

## GO2DECODE | STANDARD OPERATOR TRAINING

### Automatic and Manual Recognition, Analysis and Decoding of Communications Signals

The go2DECODE Standard Operator Training course familiarizes the Students with all go2DECODE components and functions, and their practical use. The course focuses development of the Students' knowledge of signals analysis techniques and procedures using go2DECODE. Configuration and parameter settings of demodulators and decoders for automatic detection of new modems are explored in detail.

During training delivery, the Students' skillsets are developed using practical 'real world' exercises employing live signal recordings sourced by PROCITEC and, optionally, the Students' User-Units. Upon completion of training, Students will understand the functionalities and capabilities of go2DECODE, and will have acquired skills in the analysis of modulated signals and creating effective modems for manual or automatic signal recognition, decoding and reporting.

### COURSE CONTENT:

- ✓ General System Introduction
- ✓ Fundamentals of digital signal modulation
- ✓ Signal inputs, interfacing and adjustments (DANA)
- ✓ Signal Simulation Tool (SOMO)
- ✓ Rapid Pre-Classification of Modulation Types
- ✓ Analysing FSK, MFSK and PSK Signals
- ✓ Setting Up Demodulators and analysis of Demodulation Results
- ✓ Setting Up Modems and Modem Lists
- ✓ Automatic Production and Signal Recording
- ✓ Introduction to Decoder Description Language (DDL) and decoder adaptation

### TARGET AUDIENCE:



Technical staff involved in writing, modifying and editing signal-decoders



Signals Analysts

### ENTRY CRITERIA

Basic understanding of the RF Spectrum and signaling techniques

### COURSE DURATION:

4 days / 32 training hours for a maximum of 8 Students

### CONTACT US

For further information please contact our sales team: ✉ [sales@procitec.com](mailto:sales@procitec.com)

## GO2SIGNALS | DDL/PYDDL TRAINING

### **Decoder Description Language (DDL/pyDDL). Fundamentals for Developing and Adapting Signals Decoders**

In this training course, Students are introduced to the fundamentals and general use of the go2signals Decoder Description Language (DDL/pyDDL). All essential functions and commands are described in detail. The course focusses towards adaptation of existing decoders, design of new decoders, and use of the decoder development toolset.

The course also captures the basics of channel coding and the fundamentals of forward error correction techniques. Upon completion of the course, Students will be able to use DDL/pyDDL to modify and create new decoders for use in the go2signals range of software products.

#### **COURSE CONTENT:**

- ✓ Lectures and practical exercises
- ✓ Introduction and Overview
- ✓ Basic Steps to Create and Modify Decoders
- ✓ Basic Language Elements
- ✓ Discussion of Simple Decoder Programs
- ✓ Basic Language Structure, Functions and Interfaces
- ✓ Use of Decoder Editor and Debugger
- ✓ Detailed Discussion of Vital Commands
- ✓ Special Aspects of Automatic Production
- ✓ Exercises in Writing Simple Decoders
- ✓ Methods of Error Detection and Correction

#### **TARGET AUDIENCE:**



Technical staff involved in writing, modifying and editing signal-decoders

#### **ENTRY CRITERIA**

Completion of go2DECODE Basic Training and some experience in alternative software programming languages; it is strongly recommended that all Students per-course have a similar start-state.

#### **COURSE DURATION:**

4 days / 32 training hours  
for a maximum of 5 Students

#### **CONTACT US**

For further information please contact our sales team: ✉ [sales@procitec.com](mailto:sales@procitec.com)



## GO2DECODE | IN TACTICAL OPERATIONS

### Exploitation of Communications Signals For Situational Awareness

#### COURSE CONTENT:

- ✓ go2DECODE running on low-SWaP Laptop or Portable PCs with low display resolution
- ✓ Terminologies and Signals: Student refresh for tactical context
- ✓ Radio-communications network topologies (civil / military / paramilitary)
- ✓ Data modulation techniques HF-UHF (tactical focus)
- ✓ V/UHF Signals Of Interest (tactical focus – Line-Of-Sight [LOS] / point-to-point / multipoint direct and trunked networks)
- ✓ HF Signals Of Interest (tactical focus – short-range groundwave and 'Near Vertical Incidence Skywave' ['NVIS'] propagation)
- ✓ Operational focus – automatic and manual signals recognition, analysis, decoding and reporting in real-time
- ✓ Operational scenarios based upon Land, Littoral and Maritime Tactical Use-Cases

#### TARGET AUDIENCE:



Military and Security Communications Surveillance Operators using light / mobile sensor systems with integrated go2DECODE capabilities.

#### ENTRY CRITERIA

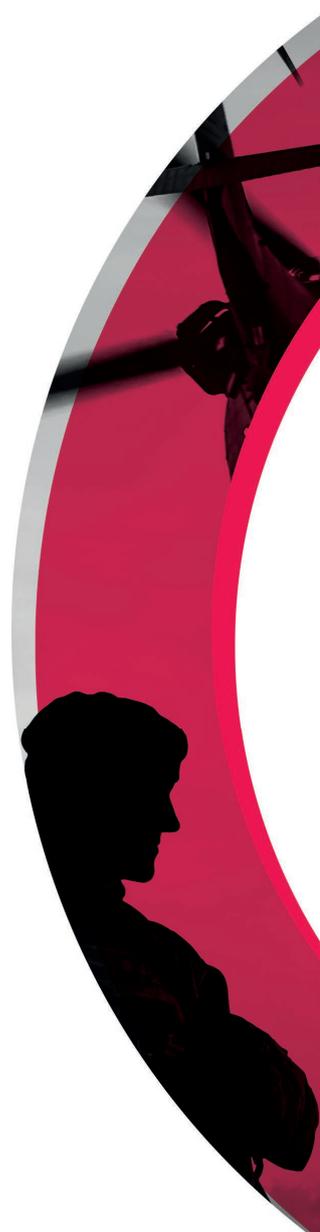
A basic knowledge of the RF spectrum, signaling techniques and Tactical Operations

#### COURSE DURATION:

4 days / 32 training hours for a maximum of 10 Students

#### CONTACT US

For further information please contact our sales team: ✉ [sales@procitec.com](mailto:sales@procitec.com)



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**Management System**  
ISO 9001:2015

