CATHODIC PROTECTION

Design >

Construction >

Equipment >

Maintenance >

PA-EL d.o.o.

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INTRODUCTION

PA-EL is a leading company in Croatia and region in the field of Cathodic Protection design, equipment, installation and maintenance for:

- pipelines
- storage tanks
- reinforced concrete structures
- offshore structures and ships
- other specific structures

PA-EL is in private ownership and was founded by Mr. Stjepan Pavliša in 1993.

Mr. Stjepan Pavliša
(Founder and managing partner)

Commercial sector, general manager's office, accounting and office specialized in preparation of certification and technical documentation are located at Dubrovčan 33b, Veliko Trgovišće.

The company has a residential and business building with a hall for production and service, designing sector, department for ATEX installation, warehouse, quality control sector and corrosion laboratory at the location Ksavera Šandora Gjalskog 55a, Veliko Trgovišće.

PA-EL is certified with:

- ISO 9001 (quality management system)
- ISO 14001 (environment management system)
- ISO 45001 (occupational health and safety management system)
- ISO 29001 (sector-specific quality management system)
- CRS certifikat (for services on ships and offshore platforms)
- Certifikat za ATEX zone (for installation, maintenance, diagnostics)

Our experts have designed, manufactured and installed our equipment on more than 4000 different structures in Croatia, Southeast Europe, Algeria, Russia, India and UAE. Our personnel regularly attends meetings of experts around the globe.

Technical solutions and equipment are in accordance with the most relevant standardization bodies, such as ISO, EN, NACE, Norsok, Lloyd, ASTM, API etc…

INTRODUCTION

Our CP engineers are certified at National Association for Corrosion Engineering (NACE) and British Institute of Corrosion which ensures us with the most recognized International competence level.

We are able to offer you our services in:

DESIGN AND CONSULTING

- consultation
- feasibility study
- concept design
- main design
- as built design
- technical documentation

We can also offer you design and consulting for ATEX zones and odorization stations.

DIAGNOSTICS

- corrosion diagnostics (corrosion potentials, redox potential, soil resistivity, soil pH, chloride and sulphate content…)
- diagnostic of existing CP systems
- evaluation of ac and dc corrosion likelihood (interferences)
- CP interference on neighboring pipelines
- simultaneous multichannel data logging
- Pearson, PCM & Holiday detection
- groundings and lightning rods inspection

CATHODIC PROTECTION INSTALLATION AND COMMISIONING

Regarding cathodic protection installation on work sites,
PA-EL mostly participates as a subcontractor of larger contractors.

Quality, quick service as well as installation within deadlines make us a trustful partner.

Our equipment installed on site fully complies with Investors demands.

COATING INSPECTION

Aged or new, coatings applied onto substrate often require 3rd party inspection.

Our team supervised by certified Coating Inspector can offer such service.

INTRODUCTION

MAINTENANCE

- corrective maintenance
- preventive maintenance
- system testing commissioning
- training courses for engineers and technicians upon client's demand

For each Cathodic Protection system entrusted to us, we have personalized instruction manuals (guidebooks) for maintenance, all in accordance with:

- technical manuals of equipment producer
- design requirements
- performers requirements
- standards and recommendations
- good engineering practice

CATHODIC PROTECTION EQUIPMENT

PA-EL is able to provide you with all of the equipment that you need in cathodic protection systems.

At one place you can order transformer/rectifier units (manual and automatic control), FeSiCr, Mg, Zn and Al anodes, MMO tubular and wire anodes, reference electrodes, polarization cell, cables, metallurgical coke, polyester/steel cabinets and test posts, software and SCADA systems for cathodic protection and also for odorization stations.

CONTENT

AIR COOLED TRANSFORMER RECTIFIER UNIT FOR CATHODIC PROTECTION

Air cooled transformer rectifiers are power supply units for cathodic protection systems with impressed current. There are several sub-types, depending on the type of electrical connection, power, type of case etc. Custom design is available upon client's request.

Input (AC):	230 V, 1ph, 50 Hz
	400 V, 3ph, 50 Hz
Control:	Manual – multi tap transformer or variac
	Automatic – Thyristor (Current, voltage and/or potential)
Output (DC):	Voltage – Up to 150 Volt
	Current – Up to 250 Ampere
Temperature:	-5°C to +55°C
Protection:	Overload – MCB or/and fuses
	Overvoltage – MOV
Tank:	Material – steel or stainless steel
	Coating – epoxy paint finish RAL per request
Protection class:	Up to IP 65 / IK10
Cooling:	AN (Air Natural) AF (Air Forced)
Analog meter:	DC – voltage
	DC – current
Optional:	Digital voltmeter / ammeter, working hour meter, non-synchronized interrupter, GPS synchronized interrupter, 4-20 mA measuring converter, protection time counter, GPRS/Ethernet data transmission module, etc.

TECHNICAL DATA SHEET

EXAMPLES OF AIR COOLED TRANSFORMER RECTIFIER UNIT FOR CATHODIC PROTECTION








OIL COOLED TRANSFORMER RECTIFIER UNIT FOR CATHODIC PROTECTION

Oil cooled transformer rectifiers are power supply units for cathodic protection systems with impressed current. There are several sub-types, depending on the type of electrical connection, power, type of case etc. Custom design is available upon client's request.

Input (AC)	230 V, 1ph, 50 Hz
	400 V, 3ph, 50 Hz
Control	Manual – multi tap transformer or variac
	Automatic – Thyristor (Current, voltage and/or potential)
Output (DC)	Voltage – Up to 150 Volt
	Current – Up to 250 Ampere
Temperature:	-5°C to +55°C
Protection	Overload – MCB or/and fuses
	Overvoltage – MOV
Tank	Material – steel or stainless steel
	Coating – epoxy paint finish RAL per request
Protection class	Up to IP 65 / IK10
Cooling	ONAN (Oil Natural Air Natural)
Analog meter:	DC – voltage
	DC – current
Optional:	Digital voltmeter/ammeter, working hour meter, non-synchronized interrupter, GPS synchronized interrupter, 4-20 mA measuring converter, protection time counter, Buchholz relay, GPRS/Ethernet data transmission module, etc.

TECHNICAL DATA SHEET

EXAMPLES OF OIL COOLED TRANSFORMER RECTIFIER UNIT FOR CATHODIC PROTECTION

TECHNICAL DATA SHEET

CPCU
CATHODIC PROTECTION CONTROL UNIT

Description

CPCU (Fig.1) is a device that allows control and management of single/three-phase transformer-rectifier units for cathodic protection under the principle of automatic process control. The device can operate in seven different operating modes:

No:	MODE	Description
1	Constant U	Output voltage is determined according to setpoint U
2	Constant U with I limit	Output voltage is determined according to setpoint U and setpoint current I*
3	Constant E	Pipe to soil potential is determined according to setpoint E
4	Constant E with I limit	Pipe to soil potential is determined according to setpoint E and setpoint current I*
5	Constant I	Output current is determined according to setpoint I
6	Remote CV	Output voltage is determined 0-100% according to remote 4-20mA signal from analogue input
7	Constant CV with I limit	Output voltage is determined 0-100% according to remote 4-20mA signal from analogue input and setpoint current I*

*setpoint current I can be adjusted in MODE Const I

Fig.1: CPCU

Module characteristics

- Dimensions: 157x85x58mm
- Power supply: 12-48VDC
- Synchronization voltage:..... 230VAC - 400VAC, 50Hz or 60Hz
- Simple assembly on DIN rail
- Graphical LCD display ..... 132x32 pixels

Module functions

- Seven modes of operation: Constant U, Constant U with I limit, Constant E, Constant E with I limit, Constant I, Remote CV, Constant CV with I limit
- Four analogue inputs:
  1. configurable input range (-5V ... +5V to -20V … +20V and input impedance of 10MΩ for potential measurement
  2. 0-150Vdc for output voltage of TR measurement
  3. 0-100mVdc for output current of TR measurement
  4. 0-50Vac for Uac alternative voltage of structure measurement or NTC probe for temperature measurement
- Four digital inputs 10-30V, both can independently be assigned and configured to determine following states: 230V Power failure, 24V Power failure, Low voltage of battery, primary over current protection failure, secondary over current protection failure, primary overvoltage protection failure, secondary overvoltage protection failure, OVP-01 over voltage protection failure
- Five outputs:
- OUT1 can only be assigned as digital
- OUT2-OUT5 can be assigned as analogue as well as digital.
- Digital outputs: Relay 30Vdc/1A. Possible assignation to digital outputs are: NOT assigned, E(Low Alm), E(HighAlm), E(Alm), U(Low Alm), U(HighAlm), U(Alm), I(Low Alm), I(HighAlm), UIAlm), Uac(Alm), Door open, 230V failure, 24V failure, Low batt Alm, Prim OCP fail, Sec OCP fail, Prim OVP fail, Sec OVP fail, OVP-01 fail, Common Alm, TR ON/OFF command. Digital output configuration should be only factory configured according customer request in order of use different hardware.
- Analog outputs: standard current loop 4-20mA. Possible assignation to analogue outputs are: NOT assigned, 4-20mA(E), 4-20mA(U), 4-20mA(I), 4-20mA(Uac), 4-20mA(CV). Analog output configuration should be only factory configured according to customer request in order of use of different hardware.
- Parameter management via the front panel keypad or RS485 communication channel
- Built-in cathodic protection system diagnostic software (assignment criteria for potential, output voltage and output current of the device, Uac voltage of structure)
- All measured parameters available via the RS485 standard communication channel according to the Modbus RTU communication protocol

TECHNICAL DATA SHEET

Hardware configuration

I/O	No. of channels	Type of channel	Meas. range			Input Impedance	Resolution	Accuracy	Catalog No.
Analog inputs	4x	Voltage	-100V…+100V	DC	Average	Z = 10MΩ	0,1V	1%, ±1V	1
		Voltage	-150V…+150V	DC	Average	Z = 10MΩ	0,1V	±1%, ±1,5V	2
		Voltage	-200V…+200V	DC	Average	Z = 10MΩ	0,2V	±1%, ±1V	3
		Voltage	-100mV…+100mV	DC	Average	Z = 250 kΩ	0,1mV	±1%, ±1,5mV	4
		Voltage	-60mV…+60mV	DC	Average	Z = 250 kΩ	0,1mV	±1%, ±1mV	5
		Voltage	-5V…+5V	DC	Average	Z = 10MΩ	10mV	±1%, ±50mV	6
		Voltage	-10V…+10V	DC	Average	Z = 10MΩ	10mV	±1%, ±100mV	7
		Voltage	-20V…+20V	DC	Average	Z = 10MΩ	10mV	±1%, ±200mV	8
		NTC	-20°C…+85°C	DC	Average	Z = 10kΩ	0,1°C	±2%, ±2°C	9
		Voltage	0V…50V	AC	True RMS	Z = 10MΩ	0,1V	±1%, ±1V	A
		Not used	-						0

I/O	No. of channels	Type of channel	Input range	Catalog No.
Digital inputs	4x	Voltage	10-30V	1
		Potential free	-	2
		Not used	-	0

I/O	No. of channels	Type of channel	Output range	Min output Impedance	Max output Impedance	Resolution	Catalog No.
Outputs	5x	Analog	4-20mA DC	0Ω	600Ω	16 bit	1
		Digital	30V, 1A DC	-			2
		Not used		-			0

I/O	No. of channels	Type of channel	Communication protocol	Catalog No.
COM	2x	RS232	MODBUS RTU	1
			Custom	2
		RS485	MODBUS RTU	3
			Custom	4
		Not used	-	0

Marking of device – example: CPCU-3-1460-1111-21112-03

CPCU	-	1	-	1	4	6	0	-	1	1	1	1	-	1	1	1	2	2	-	3	0
		↓	-	AI.1	AI.2	AI.3	AI.4	-	DI.1	DI.2	DI.3	DI.4	-	OUT1	OUT2	OUT3	OUT4	OUT5	-	COM0	COM1
	1 - 1f			Analog inputs Cat. No.					Digital inputs Cat. No.					Outputs Cat. No.*						COM Cat.No.	
	3 - 3f																				

*OUT1 can only be assigned as digital

TECHNICAL DATA SHEET

UT-20
CATHODIC PROTECTION CONTROL UNIT

Description

UT-20 (Fig.1) is a device that allows control and management of single-phase transformer-rectifier units for cathodic protection under the principle of automatic process control. The device can operate in eight different operating modes:

No:	MODE	Description
1	Constant U	Output voltage is determined according to setpoint U
2	Constant U with I limit	Output voltage is determined according to setpoint U and setpoint current I*
3	Constant E	Pipe to soil potential is determined according to setpoint E
4	Constant E with I limit	Pipe to soil potential is determined according to setpoint E and setpoint current I*
5	Constant I	Output current is determined according to setpoint I
6	Remote CV	Output voltage is determined 0-100% according to remote 4-20mA signal from analogue input
7	Remote CV with I limit	Output voltage is determined 0-100% according to remote 4-20mA signal from analogue input and setpoint current I*
8	Local CV	Output voltage is determined 0-100% according to setpoint Local CV

*setpoint current I can be adjusted in MODE Const I

Fig.1: UT-20

Module characteristics

- Dimensions: ..... 157x85x58mm (W x H x D)
- Power supply: ..... 230VAC, 50Hz or 60Hz
- Synchronization voltage:..... 230VAC - 400VAC, 50Hz or 60Hz
- Backup power supply: 12-48VDC
- Simple assembly on DIN rail
- Graphical LCD display ..... 132x32 pixels

Module functions

- Eight modes of operation: Constant U, Constant U with I limit, Constant E, Constant E with I limit, Constant I, Remote CV, Remote CV with I limit, Local CV
- Four analog inputs:
  1. Configurable input range (-5V … +5V to -20V … +20V) and input impedance of 10MΩ for potential measurement
  2. 0-150Vdc for output voltage of TR measurement
  3. 0-100mVdc for output voltage of TR measurement
  4. 0-50Vac for Uac alternative voltage of structure measurement or NTC probe for temperature measurement
- Two digital inputs 10-30V, both can independently be assigned and configured to determine following states: Power failure, 24V Power failure, Low voltage of battery, primary over current protection failure, secondary over current protection failure, primary overvoltage protection failure, secondary overvoltage protection failure, OVP-01 over voltage protection failure, power ON/power OFF energy section of the device.
- Five outputs:
- OUT1 can only be assigned as digital.
- OUT2-OUT5 can be designed as analog as well as digital.
- Digital outputs: Relay 30Vdc/1A. Possible assignation to digital outputs are: NOT assigned, E(Low Alm), E(HighAlm), E(Alm), U(Low Alm), U(HighAlm), U(Alm), I(Low Alm), I(HighAlm), UI(Alm), Uac(Alm), Door open, 230V failure, 24V failure, Low batt Alm, Prim OCP fail, Sec OCP fail, Prim OVP fail, Sec OVP fail, OVP-01 fail, Common Alm, TR ON/OFF command. Digital output configuration should only be factory configured according to customer request.
- Analog outputs: standard current loop 4-20mA. Possible assignation to analogue outputs are: NOT assigned, 4-20mA(E), 4-20mA(U), 4-20mA(I), 4-20mA(Uac), 4-20mA(CV). Digital output configuration should only be factory configured according to customer request.
- Parameter management via the front panel keypad or RS485 communication channel
- Built-in cathodic protection system diagnostic software (assigned criteria for potential, output voltage and output current of the device, Uac voltage of structure).
- All measured parameters are available via the RS485 standard communication channel according to the Modbus RTU communication protocol.

TECHNICAL DATA SHEET

Hardware configuration

I/O	No. of channel	Type of channel	Meas. range			Input impedance	Resolution	Accuracy	Catalog No.
Analog inputs	4x	Voltage	-100V…+100V	DC	Average	Z = 10MΩ	0,1V	1%, ±1V	1
		Voltage	-150V…+150V	DC	Average	Z = 10MΩ	0,1V	±1%, ±1,5V	2
		Voltage	-200V…+200V	DC	Average	Z = 10MΩ	0,2V	±1%, ±1V	3
		Voltage	-100mV…+100mV	DC	Average	Z = 250 kΩ	0,1mV	±1%, ±1,5mV	4
		Voltage	-60mV…+60mV	DC	Average	Z = 250 kΩ	0,1mV	±1%, ±1mV	5
		Voltage	-5V…+5V	DC	Average	Z = 10MΩ	10mV	±1%, ±50mV	6
		Voltage	-10V…+10V	DC	Average	Z = 10MΩ	10mV	±1%, ±100mV	7
		Voltage	-20V…+20V	DC	Average	Z = 10MΩ	10mV	±1%, ±200mV	8
		NTC	-20°C…+85°C	DC	Average	Z = 10kΩ	0,1°C	±2%, ±2°C	9
		Uac	0V…50V	AC	True RMS	Z = 10MΩ	0,1V	±1%, ±1V	A
		Not used	-						0

I/O	No. of channels	Type of channel	Input range	Catalog No.
Digital inputs	2x	Voltage	10-30V	1
		Not used	-	0

I/O	No. of channels	Type of channel	Output range	Min. output impedance	Max output impedance	Resolution	Catalog No.
Outputs	5x	Analog	4-20mA DC	0Ω	600Ω	16 bit	1
		Digital	30V, 1A DC	-			2
		Not used		-			0

I/O	No. of channels	Type of channel	Communication protocol	Catalog No.
COM	2x	RS232	MODBUS RTU	1
			Custom	2
		RS485	MODBUS RTU	3
			Custom	4
		Not used	-	0

Marking of device – example: UT-20-1460-11-21112-30

UT-20	-	1	4	6	0	-	1	1	1	1	-	1	1	1	2	2	-	3	0
		AI.1	AI.2	AI.3	AI.4	-	DI.1	DI.2	DI.3	DI.4	-	OUT1	OUT2	OUT3	OUT4	OUT5	-	COM0	COM1
		Analog inputs Cat. No.**					Digital inputs Cat. No.				Outputs Cat. No.*						COM Cat. No.		

*OUT1 can only be assigned as digital

**AI.4 can only be assigned as 9 (NTC) or A (Uac)

DIGITAL DISPLAY FOR CATHODIC PROTECTION DDCP

DDCP (digital display for cathodic protection) is the name of the module which purpose is to measure all relevant signals on transformer rectifier unit.

TECHNICAL SPECIFICATIONS FOR DDCP

Module characteristics

- dimensions 85x58x157 mm (w x h x d)
- data shown on alphanumeric display 16x2 characters
- parameters overview and setting via LCD display and keypad
- mounting on DIN rail

Main Features

ANALOG INPUT	DIGITAL INPUT	ANALOG OUTPUT	DIGITAL OUTPUT
AI.1 -10V... +10V	DI.1 10-30Vdc	AO.1 4-20mA	DO.1 Relay 30V, 2A
AI.2 0-150V	DI.2 10-30Vdc	AO.2 4-20mA	DO.2 Relay 30V, 2A
AI.3 0-100mV	DI.3 10-30Vdc	AO.3 4-20mA	
AI.4 -10V... +10V	DI.4 10-30Vdc	AO.4 4-20mA	

NOTE!

Analog input range can be configured by user

- measurement of current, voltage, potential and working hours
- standard analog outputs (4 – 20mA):
  - current output
  - voltage output
  - potential
- isolated inputs and outputs
- installed programmable timer (0-999s) which performs ON/OFF mode of operation of T/R unit
- Integrated opto-isolated RS485 (half duplex) communication interface for remote data transmission: connection to the devices via the Modbus RTU protocol to the RS485 standard.
- Selection MB address MODBUS RTU communication protocol via the built-in keyboard.
- The ability to connect to a wireless GPRS network (optional) using the Modbus GPRS Gateway (conversion to MODBUS TCP protocol).

The ability to connect to a TCP / IP network (Ethernet, optics), (optional) using the Modbus Ethernet Gateway (conversion to MODBUS TCP protocol).

CATHODIC PROTECTION CORROSION METER – CPCM

CPCM (Fig. 1) unit is microprocessor intelligent device intended for measuring of corrosion rate and relevant electrical and corrosion parameters of the subject structure. The corrosion rate is measuring continuously using ER probe type MS-ER 4.2_0.5 (Fig. 3). The relevant electrical and corrosion parameters are measuring continuously using AC coupon type MSAC-Fe (Fig. 2). Measurement technique of corrosion rate is based on the measurement of thickness of the ER probe versus time. After measurement result can be easily converted to the [um/year] unit as an international standard for measuring of corrosion rate. Beside the thickness (corrosion rate), CPCM continuously measure the following electrical and corrosion parameters:

Parameters:

- a.c. current intensity of AC coupon
- d.c. current intensity of AC coupon
- Eoff potential of corrosion coupon
- Eon potential of corrosion coupon
- pipeline a.c. voltage
- a.c. current density of AC coupon
- d.c. current density of AC coupon

Fig. 1. Corrosion meter device type CPCM

TECHNICAL SPECIFICATIONS FOR CPCM

Module characteristics

- dimensions 85x58x157 mm (w x h x d)
- power supply 12-36 V d.c.
- data shown on alphanumeric LCD display 16x2 characters
- parameters overview and setting via LCD display and keypad, or via communication channel
- mounting on DIN rail

Measuring Features

Name	Description	Range	Resolution
Iac	a.c. current intensity of AC coupon	(0-10000) µA a.c.	1µA a.c.
Idc	d.c. current intensity of AC coupon	(-15000, +15000) µA d.c.	1µA d.c.
Eoff	Eoff potential of corrosion coupon	(-10000, +10000) mV d.c.	1mV d.c.
Eon	Eon potential of corrosion coupon	(-10000, +10000) mV d.c.	1mV d.c.
Uac	Pipeline a.c. voltage	(0, 5000) mV a.c.	1mV a.c.
Jac	a.c. current density of AC coupon	(0, 100) A/m^2 a.c.	0,01A/m^2 a.c.
Jdc	d.c. current density of AC coupon	(0, 150) A/m^2 a.c.	0,01A/m^2 a.c.
δ	Thickness	(0, 1000) µm	10nm

Parameters adjustment via built-in function keyboard:

- a.c. current intensity of AC coupon
- d.c. current intensity of AC coupon
- Eoff potential of corrosion coupon
- Eon potential of corrosion coupon
- Pipeline a.c. voltage
- a.c. current density of AC coupon
- d.c. current density of AC coupon
- sample rate
- Thickness of corrosion coupon
- Corrosion meter enable/disable
- Device Modbus address
- Battery voltage

Fig. 2. AC coupon Type MSAC-Fe

Fig. 3. ER probe type MS-ER 4.2_0.5

Possibility of alarm situation setting for all measured parameters with function of individually alarm enable or disable. Sample rate settings (time between two corrosion measurements) in minutes and in the range 10-65535 minutes. Device Modbus RTU address settings. Communication interface for remote data transfer: linking with Modbus master devices via MODBUS RS485 RTU protocol (Modbus TCP/IP over GPRS or ETHERNET possible with additional gateway).

TECHNICAL DATA SHEET

CATHODIC PROTECTION CURRENT INTERRUPTER
CPCI-2A ac/dc

The CPCI-2A ac (Fig. 1) Current interrupter is intended to provide an interruption the output power of a transformer rectifier within a cathodic protection installation. An outdoor Active Antenna (Fig. 2) provides a high accuracy time-clock for synchronization purposes. Alongside, the Active Antenna is a highly accurate onboard Real Time Clock (RTC) which features a temperature compensated crystal oscillator for minimizing temperature drift. RTC is battery backed up, to ensure proper operation when synchronization signal is missed or in case of power failure.

FEATURES

- Two working modes: basic (initial) "Output Mode" and "Interrupt Mode"
- Working mode is performed synchronously with Coordinated Universal Time (UTC).
- UTC time and date are in the form of standard NMEA sentences, as well as synchronization pulses PPS (1Hz) are obtained from outdoor active antenna that is connected to the device via a standard RS232 serial interface.
- Synchronization allows multiple CPCI-2A ac/dc devices to be spatially located at different remote locations, to move at the same time to the "Interrupt Mode", to perform simultaneous switching power supply voltage, and at the end to return at the same time to the basic "Output Mode".
- Build in opto-isolated communication interface based on the half duplex RS 485 standard implemented, with the Modbus RTU protocol with following features:
  - Address settings: Modbus RTU address, via keypad on the front panel
  - Communication channel 8N1 and variable baud rate settings (possible baud rates 2400, 4800, 9600, 19200, 38400, 57600 bits/s), via keypad on the front panel
  - Communication interface for remote data transfer: linking with Modbus master devices via MODBUS RS485 RTU protocol (Modbus TCP/IP over GPRS or ETHERNET possible with additional gateway).

Fig. 1. Cathodic Protection Current Interrupter type CPCI-2A ac/dc

TECHNICAL SPECIFICATIONS

CPCI-2A ac/dc:

Input Power:	Standard:	12-30V DC
	Portable edition:	230V / 50Hz AC
Dimensions:	Standard:	85x58x106 mm (WxHxD)
	Portable edition:	120x120x90 mm (Cabinet WxHxD)
Max Interrupting Voltage:		2-230V/AC, 2-350V/DC
Max Interrupting Current:		2A AC/DC
Synchronization:		via external sync signal, internal RTC
The Duration Of The Cycle:		1,2,3,4,5,6,10,12,15,20,30,60 s
Off Time:		0.1 to 59.9 s
Display		2” graphic display 128x32
Ambient Temperature		-20 °C to + 70 °C
Communication		MODBUS RTU over RS 485 standard

Outdoor Active GPS Antenna

Cold Acquisition Time	35 s
Warm Acquisition Time	10 s
PPS Time Accuracy	1 Hz, +/- 30 ns
Number Of GPS Channels	48
GPS Receiver Sensitivity	-163 dBW min.
Input Voltage	3,3 V, 100 mA
Operating Temperature	-40 C do +85 C

Slika 2. Vanjska aktivna GPS antena

CATHODIC PROTECTION CURRENT INTERRUPTER CPCI-P-50A

CPCI-P-50A is user friendly, easy to use, portable current interrupter, intended for use in cathodic protection systems measurement procedures. CPCI-P-50A turns ON and OFF the rectifiers on protected structure due to a reason of cathodic protection measurements. Measurement of ON and OFF potential shows a good explanation of the structure protection level.

SPECIFICATION

BASIC FEATURES

- processor driven portable current interrupter
- user interface: function keyboard and LCD display with backlight
- ON / OFF settings are programmable by menu; the program remains stored even without power supply
- continuously synchronized
- accuracy of the clock interruption: less than 2 msec
- two working modes: “Output Mode” and “Interrupt Mode”
- hold rectifier power ON when not interrupting (“Output Mode”)
- “Interrupt Mode” is performed synchronously with Coordinated Universal Time (UTC).
- ON / OFF cycle can be started/stopped trough programmable start and stop date and time
- magnet mounts antenna (IP65), with cable connection
- sync signal lock indicator
- date and time available on the LCD screen
- switching element: solid state relay
- switching current capacity: 50A DC
- overload protection
- power supply: rechargeable long life 12V battery with integrated battery charger (110-240 Vac / 12 Vdc)

TECHNICAL SPECIFICATIONS

- Input Power: 230V/50Hz AC
- Enclosure: -heavy-duty waterproof box, 305x270x194mm (LxWxD), IP67 protection
- Operating Interrupting Voltage: 60V DC
- Max Interrupting Current: 50A DC
- Synchronization: Continuously + Internal RTC
- The Duration Of The Cycle: 1,2,3,4,5,6,10,12,15,20,30,60 sec, 1,2,3,4,5,6,10,12,15,20,30,60 min
- Off Time: 0.1 to 59.9 sec, 1 to 59 min
- Display: 2” graphic LCD display 128x64
- Ambient Temperature: -25°C to + 55°C
- Communication: -
- Weight: approx. 7kg
- **NOTE:**
- Specifications can be modified according to user demands

ACCESSORIES

- 01 GPS antenna with 3m connection cable (installed)
- 01 rechargeable battery set (1x12V DC / 7.0Ah; integrated inside of the device)
- 01 suitable battery charger 110-240 Vac, 50 Hz (integrated inside of the device)
- 01 power supply cable 110-240 Vac, 50 Hz
- 02 interruption cables (2m each, 4mm^2 cross-section), with flexible connectors and clips
- 01 Certificate of Origin
- 01 User Manual (on English and on French)

Outdoor Active Antenna

Cold Acquisition Time: 35s
Warm Acquisition Time: 10s
PPS Time Accuracy: 1Hz, +/-30 ns
Number of Channels: 48
Receiver Sensitivity: -163 dBW min.
Input Voltage: 3.3 V, 100 mA
Operating Temperature: -25°C to +55°C

TECHNICAL DATA SHEET

CATHODIC PROTECTION CURRENT INTERRUPTER CPCI-P-100A

CPCI-P-100A is user friendly, easy to use, portable current interrupter, intended for use in cathodic protection systems measurement procedures. CPCI-P-100A turns ON and OFF the rectifiers on protected structure due to a reason of cathodic protection measurements. Measurement of ON and OFF potential shows a good explanation of the structure protection level.

BASIC FEATURES

- processor driven portable current interrupter
- user interface: function keyboard and LCD display with backlight
- ON / OFF settings are programmable by menu; the program remains stored even without power supply
- continuously synchronized
- accuracy of the clock interruption: less than 2 msec
- two working modes: "Output Mode" and "Interrupt Mode"
- hold rectifier power ON when not interrupting ("Output Mode")
- "Interrupt Mode" is performed synchronously with Coordinated Universal Time (UTC).
- ON / OFF cycle can be started/stopped trough programmable start and stop date and time
- magnet mounts antenna (IP65), with cable connection
- sync signal lock indicator
- date and time available on the LCD screen
- switching element: solid state relay
- switching current capacity: up to 100A DC at 150V DC
- power supply: rechargeable long life 12V battery with integrated battery charger (110-240 Vac / 12 Vdc)

For installation in safe area only.
Not for use in hazardous areas!!!

Outdoor Active Antenna:	
Cold Acquisition Time	35 s
Warm Acquisition Time	10 s
PPS Time Accuracy	1 Hz, +/- 30 ns
Number Of Channels	48
Receiver Sensitivity	-163 dBW min.
Input Voltage	3.3 V, 100 mA
Operating Temperature	-5°C do +55°C

TECHNICAL SPECIFICATIONS

- Input Power: 230 / 50Hz AC
- Enclosure: heavy-duty waterproof box; 410 x 340 x 205 mm (LxWxD); IP67 protection;
- Operating Interrupting Voltage: 0 – 150V DC
- Max Interrupting Current: 100A DC
- Synchronization: Continuously + Internal RTC
- The Duration Of The Cycle*: 1,2,2,3,4,5,6,10,12,15,20,30,60 sec; 1,2,2,3,4,5,6,10,12,15,20,30,60 min;
- Off Time:0.1 to 59.9 sec; 1 to 59 min;
- Display: 2” graphic LCD display 128x64
- Ambient Temperature: -5°C to +55°C
- Communication: -
- Weight: 16 kg

*Duration Of The Cycle = OFF Time + ON Time

ACCESSORIES

- 01 antenna with 3m connection cable
- 01 rechargeable battery set (1x12V DC / 7.0 Ah; integrated inside of the device)
- 01 suitable battery charger 110-240 Vac, 50 Hz (integrated inside of the device)
- 01 power supply cable 110-240 Vac, 50 Hz
- 02 interruption cables (2m each, 70mm^2 cross-section), with flexible connectors and clips
- 01 Certificate of Origin
- 01 User Manual

NOTE:

Specifications can be modified according to user demands.

CATHODIC PROTECTION DATA LOGGER CPDL-1

Cathodic protection data logger CPDL-1 is a microprocessor-based device that allows measurement techniques and data recording. The recorded data is saved to a micro-SD (Secure Digital SD) card in a .csv file format (Microsoft Excel Comma Separated Values File). Such files are easily transferred to a PC where they can be further processed. Using standard MS Office applications (MS Excel) data can be edited and reports created.

MAIN ADVANTAGES

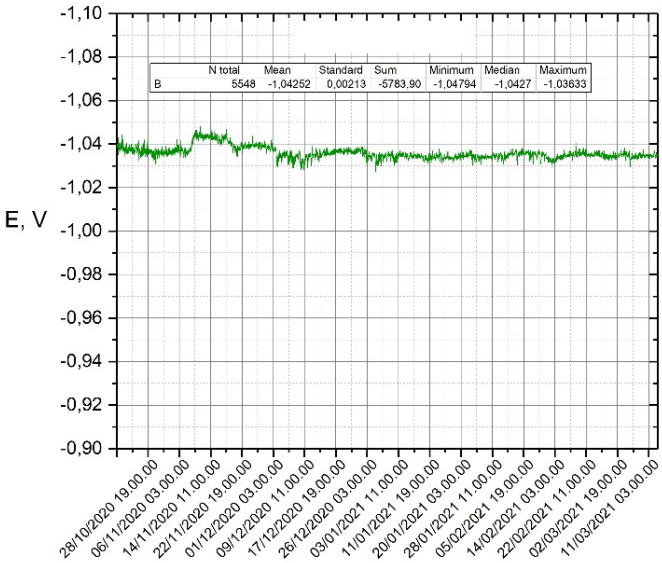
- single channel & heavy duty
- long term data logging (years)
- long life cycle battery
- tracks CP from the day “0” onwards
- acts as a CP “black box”
- sample rate from 1/second to 1/month

Dimensions

- width 70mm (2,76’’) x height 40 mm (1,57’’) x depth 131 mm (5,16’’)

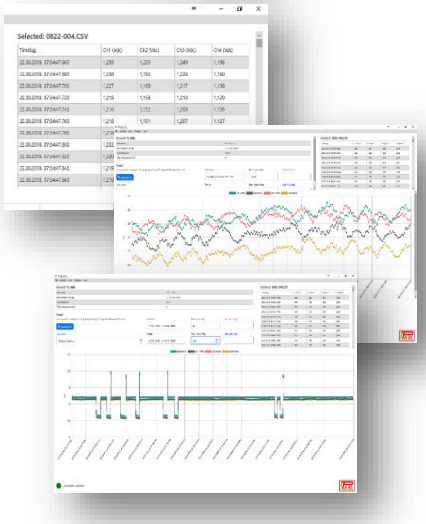
Main Features

- power supply - Li non-rechargeable battery built-in inside the compartment with minimal 1-year autonomy (1 log/hour)
- IP66 housing
- USB port for data download
- 1 analog input with input impedance > 10MΩ
- Measuring range: -4V….+4V dc
- Precision <=0,2% of full scale
- Sample rate – programable time base from 1s to 2^{32}s
- Memory – flash memory with 8 MB capacity
- PC application for data download and conversion to the PC in .csv file format (Comma Separated Values File)



CATHODIC PROTECTION DATA LOGGER CPDL-4

Cathodic protection data logger CPDL-4 is a microprocessor-based device that allows measurement techniques and data recording. The recorded data is saved to a micro-SD (Secure Digital SD) card in a .csv file format (Microsoft Excel Comma Separated Values File). Such files are easily transferred to a PC where they can be further processed. Using standard MS Office applications (MS Excel) data can be edited and reports created.



Dimensions

- width 85mm (3,34'') x height 58 mm (2,28'') x depth 157 mm (6,18'')

Main Features

- Real time operation
- Operating temperature: -5ºC to +50ºC
- Recording at the same time on four analog input channels
- 4 analog inputs:
  - input impedance > 10M
  - Channel 1 (Ch1) - Measuring range: -10V ÷ +10V
  - Channel 2 (Ch2) - Measuring range: -10V ÷ +10V
  - Channel 3 (Ch3) - Measuring range: -10V ÷ +10V
  - Channel 4 (Ch4) - Measuring range: -10V ÷ +10V
- Precision <= 0.2% of full range
- Sample rate – 1 ÷ 100 time in seconds
- Memory – micro SD card up to 2GB (> 70000 measurements)
- Synchronized switch: 15A, 70V AC/DC
- Power supply – Li-Ion rechargeable battery inside the unit or external battery of larger capacity – optional (charging inside the unit over 230V AC power adapter)
- Operation on the 230V AC power adapter / charger
- Operation autonomy >= 24 hours
- LCD display to show measured values and settings menu:
  - view of current measured values for each channel (Ch1, Ch2, Ch3, Ch4)
  - menu to select the recording speed (1 ÷ 100 time in seconds)
  - menu to select the measurement method
  - menu to set the real time clock
- Function keyboard for setting and reading the current parameters
- Built-in synchronized current interrupter with programable ON-time and cycle time
- The ability to record depolarization curves on the measuring probe. Device has a built-in relay is connected to the feeder at the cathodic protection measuring point. Device generates program-controlled interrupts and sets up a galvanic connection between the measuring probe and measurement excerpts from the pipeline.
- PC application for data download and graphic presentation (not necessary for retrieving the data to PC, or for editing the data)
- possibility of extracting, editing and analyzing the collected data without any additional software, the data can directly be opened by MS Excel application

Standard set

- Instrument CPDL-4
- Protection case
- Cables for measuring and connection, 8x0,75mm^2, four channels, cable ends with banana connectors
- Power supply Li-Ion rechargeable battery
- 230V AC power supply adapter / charger
- Memory micro-SD 2GB card with adapter
- PC connection cable
- PC Application for data download and graphic presentation
- Detailed product documentation (user manual, certificates, etc.)

JUNCTION BOX

Junction box (anode/cathode) is used in cathodic protection systems. It is mainly used for adjustment of distribution and manual monitoring of cathodic protection impressed currents. Junction box type is selected to suit environmental conditions, depending on whether it is used in non-hazardous or hazardous areas.

SPECIFICATION

DIMENSIONS

- Depending on the installed equipment

ENCLOSURE

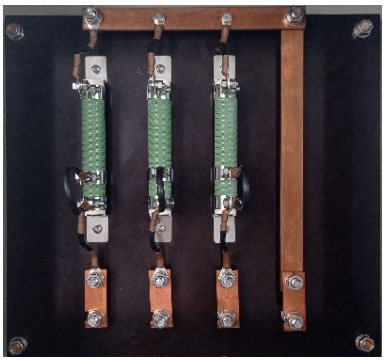
- made of epoxy coated steel (RAL per request), stainless steel (INOX 304L/316L) or GRP
- IP55 (or per request)
- IK 10

ACCESSORIES (per customer request)

- adjustable resistors
- shunts
- terminals up to 1x50 mm^2
- blocking diodes
- filters
- copper strip
- supporting pipe(s) diameter 2” / 3” or frame

INSTALLATION

- in soil
- in concrete



TEST POST MRO(S)

MRO(S) is used for cable connections arising from underground metallic structures under Cathodic Protection. Different connections can be derived on Test Post main board, such as reference cell, coupons, anodes etc. Main Board provides space for smaller electrical devices as well (switchers, fuses, overvoltage protectors etc.).

SPECIFICATION (MANUFACTURE STANDARD)

GEOMETRY

– Per customer request

NOTE!

Test posts are available according to specified standard sizes; however other sizes are available on special request.

COMPOSURE

– made of epoxy coated steel (RAL 7033)
or stainless steel (INOX 304L/316L)

ACCESSORIES

– bakelite main board
– cable terminals (up to 1x35mm)

INSTALLATION

– in soil
– in concrete

NOTE:
Specification can be changed according to user demands.

TEST POST
OT 28SF4 + FWP-2

Measuring pillar (test post) is used for cathodic protection systems, industrial distributive center, networks, wirings etc. Main function is to connect cables from pipeline or other structures as well as for installation of other equipment, such as compensation devices, polarization cell etc.

SPECIFICATION (MANUFACTURE STANDARD)

GEOMETRY

Cabinet:	250 mm x 260 mm x 848 mm (LxWxH)
Pedestal:	250 mm x 260 mm x 1126 mm (LxWxH)
Cabinet + Pedestal:	250 mm x 260 mm x 1974 mm (LxWxH)

COMPOSURE

- polyester + glass fiber
- colour: RAL 1003 or according to user demands.

ACCESSORIES

Protection degree:	IK-10; IP-44
Nominal insulation voltage:	AC 690 V
Operating temperature:	-50°C + 85°C
Flammability class:	V0
Protection class:	II
Norms:	EN 62208:2011, EN 60529:2003, EN 60695-1-10:2002 + A:2005

INSTALLATION

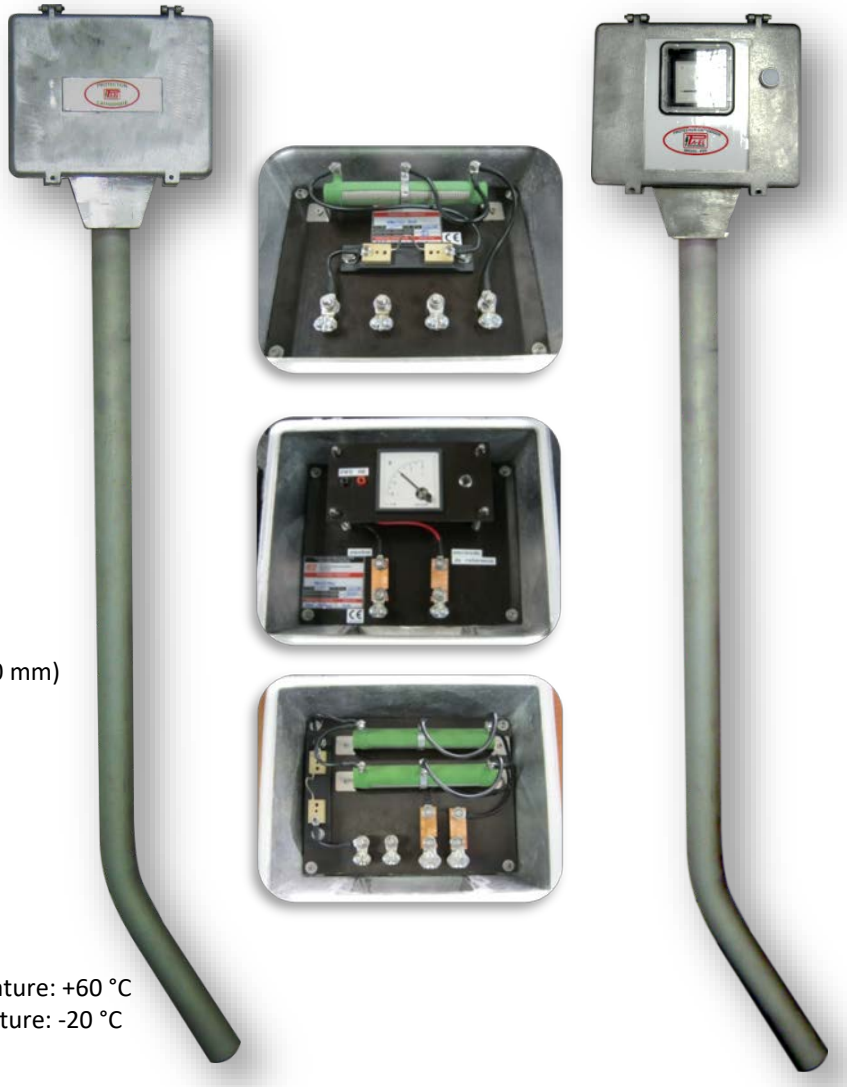
- in soil (on pedestal, type as FWP)
- on concrete made pedestal

Country of origin: Poland

TEST POST MRO(S) – ALU

MRO(S) - ALU is used for cathodic protection systems, industrial distributive centers, networks, wirings etc. Main function is to connect cables from pipeline or other structures.

SPECIFICATION (MANUFACTURE STANDARD)



GEOMETRY

- per customer request

COMPOSURE

- aluminum alloy box, IP 55
- galvanized steel supporting pipe
- bakelite main board

ACCESSORIES

- connection terminals
- removable copper strips
- adjustable resistors
- current measuring shunts
- voltmeter
- spark gaps
- window on front panel (110x110 mm)

INSTALLATION

- in soil
- in concrete

OPERATING CONDITIONS

- maximum environment temperature: +60 °C
- minimum environment temperature: -20 °C
- humidity: 95%

Depending on customer requirements, the MRO (S)-ALU can be used for the following functions:

1. Adjustment of distribution and manual monitoring of cathodic protection impressed current
2. Balance potential (solve interference) between protected and foreign pipeline
3. Potential measurement between protected pipeline and reference electrode.
4. Protection of insulation flange, distribution of cathodic current and for effectiveness testing of insulation flange

TECHNICAL DATA SHEET

ION-RESISTANT RETENTION STATIONARY REFERENCE ELECTRODE IRRS-Cu

IRRS-Cu reference electrode is used in cathodic protection systems for long term application. It provides potential measurement of embedded and immersed metal structures, and reinforced steel structures. Owing small dimension IRRS-Cu can be applied in narrow places where is impossible to settle electrodes of a larger size.

A membrane thickness, granulation and porosity, as well as retention property of electric mud makes this electrode soppy even in most extreme dry conditions. Dry-wetting process in soil won't destroy IRRS-Cu, and potential reading will stay stable. Ionic blocker inside the electrode will keep halogen ions away from copper surface.

GEOMETRY

- length 190 mm (7.48'')
- diameter 46 mm (1.81'')
- exchange surface 27444 mm^2
- mass 590 g

ELECTROCHEMICAL SYSTEM

- Cu/CuSO4 sat.
- E (IRRS-Cu) vs. E (H2) = 318 mV

RETENTION SYSTEM

- porous membrane + electric mud + ionic exchanger

STABILITY

- potential stability: $\Delta E \leq 10$ mV
- current load: In ≤ 3 µA
- temperature range 0° C till 55° C
- life time 30 years

INSTALLATION

In water:
- on PE carriers
- on PE cord with dead weight
- on bottom covered with natural mud

In soil:
- embedded in sand or soil
- embedded in soil with electric mud or coke backfill in 10 cm layer around electrode

In concrete:
- suffused with concrete

BACKFILL (OPTION)

- per customer request

ION-RESISTANT RETENTION STATIONARY REFERENCE ELECTRODE WITH INTEGRATED DC COUPON

IRRS-Cu-Msdc reference electrode with DC measuring coupon is used in cathodic protection systems for long term application. It provides potential measurement of embedded and immersed metal structures, and reinforced steel structures. Owing small dimension IRRS-Cu-Msdc can be applied in narrow places where is impossible to settle electrodes of a larger size.

A membrane thickness, granulation and porosity, as well as retention property of electric mud makes this electrode soppy even in most extreme dry conditions. Dry-wetting process in soil won't destroy IRRS-Cu-Msdc, and potential reading will stay stable. Ionic blocker inside the electrode will keep halogen ions away from copper surface.

DC measuring coupon simulates small coating holiday among the pipeline which is most vulnerable to the corrosion. Measuring probe is constituent part of cathodic protection system of underground pipes or other metallic structures. It is used for E_{OFF}/E_{ON} potential measurement.

GEOMETRY

- length 190 mm (7.48'')
- diameter 46 mm (1.81'')
- exchange surface 27444 mm^2
- mass 590 g

ELECTROCHEMICAL SYSTEM

- Cu/CuSO4 sat.
- E (IRRS-Cu) vs. E (H2) = 318 mV

RETENTION SYSTEM

- porous membrane + electric mud + ionic exchanger

STABILITY

- potential stability: $\Delta E \leq 10$ mV
- current load: In ≤ 3 µA
- temperature range 0° C till 55° C
- life time 30 years

INSTALLATION

In water:
- on PE carriers
- on PE cord with dead weight
- on bottom covered with natural mud

In soil:
- embedded in sand or soil
- embedded in soil with electric mud or coke backfill in 10 cm layer around electrode

In concrete:
- suffused with concrete

CONNECTING CABLE

- type: EYY-J 4x2,5 mm^2
- length = 5 m
- or per customer request

DC MEASURING COUPON

- carbon steel
- active surface 19.6 cm^2

MAINTENANCE

- no maintenance

ION-RESISTANT RETENTION STATIONARY REFERENCE ELECTRODE WITH INTEGRATED AC COUPON

IRRS-Cu-Msac reference electrode with AC measuring coupon is used in cathodic protection systems for long term application. It provides potential measurement of embedded and immersed metal structures, and reinforced steel structures. Owing small dimension IRRS-Cu-Msac can be applied in narrow places where is impossible to settle electrodes of a larger size.

A membrane thickness, granulation and porosity, as well as retention property of electric mud makes this electrode soppy even in most extreme dry conditions. Dry-wetting process in soil won't destroy IRRS-Cu-Msac, and potential reading will stay stable. Ionic blocker inside the electrode will keep halogen ions away from copper surface.

AC coupon simulates small coating holiday among the pipeline which is most vulnerable to the a.c. corrosion. Thus, its surface is 1 cm^2. It is used for a.c. corrosion evaluation in area of high a.c. corrosion risk (HV power lines, a.c. traction system etc.) according to the CEN/TS 15280.

GEOMETRY

- length 190 mm (7.48'')
- diameter 46 mm (1.81'')
- exchange surface 27444 mm^2
- mass 590 g

ELECTROCHEMICAL SYSTEM

- Cu/CuSO4 sat.
- E (IRRS-Cu) vs. E (H2) = 318 mV

RETENTION SYSTEM

- porous membrane + electric mud + ionic exchanger

STABILITY

- potential stability: Δ E ≤ 10 mV
- current load: In ≤ 3 µA
- temperature range 0° C till 55° C
- life time 30 years

INSTALLATION

In water:
- on PE carriers
- on PE cord with dead weight
- on bottom covered with natural mud

In soil:
- embedded in sand or soil
- embedded in soil with electric mud or coke backfill in 10 cm layer around electrode

In concrete:
- suffused with concrete

CONNECTING CABLE

- type: EYY-J 4x2,5 mm^2
- length = 5 m
- or per customer request

AC MEASURING COUPON

- carbon steel
- active surface 1 cm^2

MAINTENANCE

- no maintenance

PORTABLE REFERENCE ELECTRODE
PRE-Cu

Portable reference electrode PRE-Cu is part of the cathodic protection system of underground pipes or other metallic structures. It is used for EOFF/EON and free corrosion potential measurement.

The portable reference electrode PRE-Cu is used for electric potential measurements on buried structures such as pipelines, underground storage tanks and reinforced concrete structures, or generally for all underground/immersed structures. It can be also used in corrosion diagnostics. Submersible adapters are also available to ensure their usage in water tanks and other vessels.

GEOMETRY

- length 205 mm (9,13'') x diameter Ø31 mm (1,22'')
- mass 240 g

ELECTROCHEMICAL SYSTEM

- Cu/CuSO4 sat.
- E (IRRS-Cu) vs. E (H2) = 318 mV

RETENTION SYSTEM

- porous membrane (sintered ceramics)

STABILITY

- potential stability: Δ E ≤ 10 mV
- current load: IN ≤ 3 µA
- temperature range 0º C to 55º C

MANUAL AND MAINTAINANCE

- fill the cell with distillate or regular water up to 2/3 of total volume by opening the LOWER winding (on side of ceramics head) easily using rubber cap
- try to keep head of electrode always soppy by adding a few drops into rubber cap
- ensure solid contact between electrolyte (soil) and cell
- after measurement done wipe of head of electrode and put back rubber head
- sea water application is not recommended (use rather PRE-Zn seawater)
- by the time electrode might lose water; simply add new water
- in order to avoid unsaturation of the solution inside the electrode chamber always check for blue crystals of copper sulphate; add new if there is none of crystals

If you experience the reference electrode potential shift of more than 10 mV replace the content inside the chamber and clean copper bar with grind material.

WARNING!

Do not use PRE-Cu in seawater nor any high chloride environment! Exceptionally it may be used for short period (e.g. couple of hours), but then cleaning a copper bar and replacing the electrolyte is highly recommended.

For seawater application rather refer to PRE-Zn reference electrode.

PORTABLE REFERENCE ELECTRODE
PRE-Zn

Portable reference electrode PRE-Zn is constituent part of cathodic protection system in sea water (offshore structures, bridges, ships…).

PRE-Zn is specially adopted for easy validity check and current distribution of Zn or Al protectors on boat undercarriage.

Submersible adapters are also available to permit their use in water tanks and other vessels.

GEOMETRY

- length 197 mm (7,75'') x diameter Ø31 mm (1,22'')
- electrochemical surface 22 cm2
- mass 250 g

ELECTROCHEMICAL SYSTEM

- Zn - Sea Water
- E (PRE-Zn) vs. E (NHE) = - 0.78 mV
- E (PRE-Zn) vs. E (kalomel) = - 1.02 mV

RETENTION SYSTEM

- porous membrane (sintered ceramics)

STABILITY

- potential stability: Δ E ≤ 10 mV
- current load: In ≤ 3 µA
- temperature range 0° C do 55° C

MANUAL AND MAINTAINANCE

- Brush the zinc head once a while.

DC COUPON MS – 96

DC coupon simulates a small coating holiday along the pipeline which is most susceptible to the corrosion. MS-96 measuring probe is constituent part of cathodic protection system of underground pipes or other metallic structures. It is used for E_{OFF}/E_{ON} potential measurement. Installation is according to CP design of a nearby pipeline (structure), mostly paired with embedded reference electrode IRRS-Cu ($Cu/CuSO_4$).

GEOMETRY

- length 85 mm
- width 55 mm
- height 60 mm
- (PVC knee)
- active surface 1963 mm^2
- mass 350 g

PROPERTIES

- working temperature 0º C to 58º C
- life time over 10 years

INSTALLATION

- In soil, according to design, mostly in pair with embedded reference electrode IRRS-Cu, nearby of the structure

CONNECTING CABLE

- type as NYY 2x2,5 mm^2

AC COUPON MSAC – Fe

AC coupon simulates small coating holiday among the pipeline which is most vulnerable to the a.c. corrosion. Thus, its surface is 1 cm^2. It is used for a.c. corrosion evaluation in area of high a.c. corrosion risk (HV power lines, a.c. traction system etc.) according to the CEN/TS 15280.

GEOMETRY

- L-shaped, 111x111 mm
- diameter 23 mm, active diameter 11 mm
- active surface 1 cm^2
- mass 150 g

PROPERTIES

- working temperature 0º C to 58º C
- life time over 10 years

INSTALLATION

- In soil, near a.c. facilities or on spots of high a.c. corrosion risk

CONNECTING CABLE

- type as NYY 2x2,5 mm^2

VISIBILITY IN SOIL

- gray PVC knee

ON SITE FUNCTIONALITY CHECK

- Once in a year, check the electric continuity

NOTE!

- MSAC-Fe is one-time product. If malfunction obtained it is necessary to replace probe with new one.

SOLID-STATE POLARIZATION CELL
PPĆ-X-AC

Solid-state polarization cell PPĆ-X-AC is semiconductor cell used with cathodically protected structures (pipelines, tanks, grounding systems) for DC decoupling, AC continuity/grounding (AC version), protection from lightning current and AC faults. PPĆ-X-AC must be installed in enclosure/test post/test station with a degree of protection IP44 or higher. Solid-state polarization cells (PPĆ-X-AC) are not intended for use in potentially hazardous areas.

SPECIFICATION

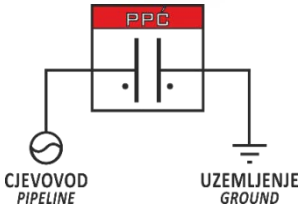
PPĆ-1-AC		**PPĆ-2-AC**		**PPĆ-3-AC**	
Dimension:	165x270x100 mm	Dimension:	196x284x146 mm	Dimension:	196x284x146 mm
Mass:	2,1 kg / 2,5 kg	Mass:	7,1 kg / 8,0 kg	Mass:	8,6 kg / 9,5 kg
Cable:	H07V-K 1x16 mm^2	Cable:	H07V-K 1x25 mm^2	Cable:	H07V-K 1x35 mm^2

Operating Temperature: -25°C to +55°C

		PPĆ-1-AC	**PPĆ-1**
AC steady state current (50/60 Hz):		35 A	
Lightning surge current (8/20 µS):		40 kA	40 kA
AC fault current (30 cycles @ 50/60 Hz):		1,0 kA	1,0 kA
DC threshold voltage:	standard:	-3/+1 V	-3/+1 V
	optional:	-2/+2 V	-2/+2 V

		PPĆ-2-AC	**PPĆ-2**
AC steady state current (50/60 Hz):		60 A	
Lightning surge current (8/20 µS):		40/100 kA	40/100 kA
AC fault current (30 cycles @ 50/60 Hz):		4,0 kA	4,0 kA
DC threshold voltage:	standard:	-3/+1 V	-3/+1 V
	optional:	-2/+2 V	-2/+2 V

		PPĆ-3-AC	**PPĆ-3**
AC steady state current 50/60 Hz:		80 A	
Lightning surge current 8/20 µS:		100 kA	100 kA
AC fault current (30 cycles @ 50/60 Hz):		6,0 kA	6,0 kA
DC threshold voltage:	standard:	-3/+1 V	-3/+1 V
	optional:	-2/+2 V	-2/+2 V



SOLID-STATE POLARIZATION CELL PPĆ 14kA

Solid-state polarization cell is semiconductor cell used with cathodically protected structures (pipelines, tanks, grounding systems, etc.) for DC decoupling and AC continuity/grounding, and also for protection from lightning current and AC faults.

SPECIFICATIONS:

DIMENSIONS

- box: 300(W) x 400(H) x 210(D) mm
- weight: 16.2 kg

TECHNICAL DATA

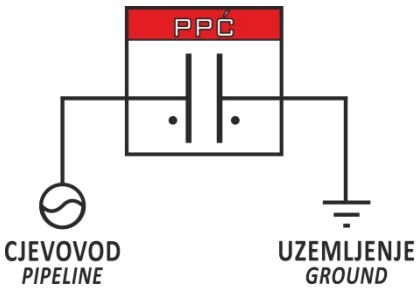
- Operating Temperature:	-25°C to +55°C
- Degree of protection:	IP65
- AC steady state current:	45 A_{rms} (50 Hz) 45 A_{rms} (60 Hz)
- Lightning surge current (8/20 µS):	100 kA
- DC threshold voltage:	-3V / +1V (optional: -2V /+2V)
- AC fault current:	33 kA (1 cycle @ 50 Hz) 35 kA (1 cycle @ 60 Hz) 14 kA (30 cycles @ 50 Hz) 15 kA (30 cycles @ 60 Hz)
- Number of Operations:	Virtually unlimited under maximum ratings, under conditions that operations are not immediately repetitive.
- Energy Requirements:	None. The device is totally passive.

STANDARDS / DIRECTIVES:

- EN 12954
- IEC 60529

NOTE:
Specifications of the unit can be modified according to user demands.

CONNECTION DIAGRAM:



ATEX SOLID-STATE POLARIZATION CELL
Ex-n PPĆ 6 kA

Solid-state polarization cell is semiconductor cell used with cathodically protected structures (pipelines, tanks, grounding systems) for DC decoupling and AC continuity/grounding, and also for protection from lightning current and AC faults. ATEX solid-state polarization cell (Ex-n PPĆ 6 kA) is intended for use in potentially hazardous areas (Zone 2 only).

SPECIFICATION (MANUFACTURE STANDARD)

GEOMETRY

- box: 300(W) x 400(H) x 200(D) mm
- mass: 15 kg

STANDARDS / DIRECTIVES:

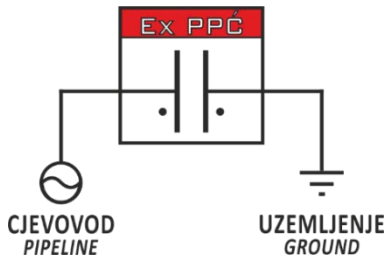
- EN 60079
- ATEX 2014/34/EU
- EN 12954
- IEC 60529

ATEX DATA

- Equipment Group: II
- Categories of devices: 3G
- Installation: Zone 2 (Gas)
- Protection mode : n, m
- Temperature class: T4
- Marking: II 3G Ex nA mc IIC T4 Gc

TECHNICAL DATA

- Operating Temperature: -20°C to +55°C
- Degree of protection: IP66
- AC steady state current: 80 A_{rms} (50 Hz)
- Lightning surge current (8/20 µS): 100 kA
- DC threshold voltage: standard: -3V / +1V
  optional: -2V / +2V
- AC fault current: 6.0 kA (30 cycles @ 50 Hz)
  12.0 kA (1 cycle @ 50 Hz)
- Number of operations: Virtually unlimited under maximum ratings, under conditions that operations are not immediately repetitive.
- Energy requirements: None. The device is totally passive.



NOTE!

Supporting frame for in-field stand-alone installation is not part of standard delivery – if required, supporting frame should be ordered separately!

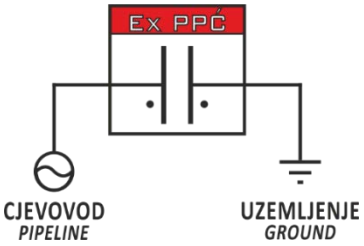
Specifications of the unit can be modified according to user demands.

ATEX SOLID-STATE POLARIZATION CELL
Ex-d PPĆ 5 kA

Solid-state polarization cell is semiconductor cell used with cathodically protected structures (pipelines, tanks, grounding systems) for DC decoupling and AC continuity/grounding, and also for protection from lightning current and AC faults.

ATEX solid-state polarization cell (Ex-d PPĆ 5kA) is intended for use in potentially hazardous areas (Zone 1, Zone 2).

SPECIFICATION (MANUFACTURE STANDARD)



GEOMETRY

- box (EJB-3B size): 364 x 284 x 218 mm
- mass: 22 kg

ATEX DATA

- Equipment Group: II
- Categories of devices: 2G
- Installation: Zone 1, Zone 2 (Gas)
- Protection mode : d (flameproof enclosure)
- Temperature class: T4
- Marking: Ex 2G Ex d IIB T4 Gb

Certification: CE B 2465 EXA 15 ATEX 0003X

STANDARDS / DIRECTIVES:

- EN IEC 60079-0:2018
- EN 60079-1:2014
- ATEX 94/9/EC
- EN 12954
- IEC 60529

TECHNICAL DATA

Operating Temperature	-25°C to +55°C
Degree of protection	IP66 / IP67

Ex-d PPĆ 5 kA

AC steady state current:	45 A_{rms} (50 Hz) 45 A_{rms} (60 Hz)
Lightning surge current (8/20 µS)	100 kA
AC fault current:	5 kA (30 cycles @ 50 Hz) 5,3 kA (30 cycles @ 60 Hz)
DC threshold voltage	-3V /+1V (standard) -2V /+2V (optional)
Number of Operations:	Virtually unlimited under maximum ratings, under conditions that operations are not immediately repetitive.
Energy Requirements:	None. The device is totally passive.

NOTE!

Specifications can be changed according to user demands!

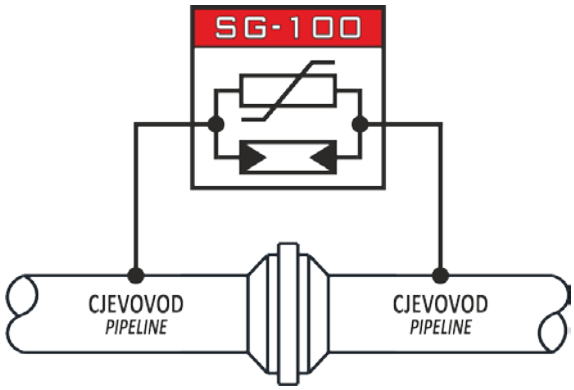
PROTECTIVE SPARK GAP SG - 100

Protective Spark Gap SG-100 is intended for protection of (buried) insulating flanges, as for drainage of induced over-voltages (atmospheric discharges) from the pipeline to the ground. Basic of the SG-100 Protective Spark Gap device is parallel connection of the spark gap together with the varistor, in the same housing. SG-100 must be installed in enclosure / test post / test station with an IP44 or higher protection level, in non-hazardous areas.

TECHNICAL SPECIFICATION

Dimensions:	160 x 120 x 90 mm
Weight:	1,2 kg
Connecting cable type :	H07V-K 1x25 mm^2
Operating Temperature :	-25°C till +55°C

Clamp voltage (U_c):	70 V_{AC} / 100 V_{DC}
Nominal discharge current (8/20 µs) (I_n) :	100 kA
Protection level (U_p):	<0,6 kV



HIGH SILICON CAST IRON ANODE

High Silicon Cast Iron Anode is constituent part of cathodic protection system of underground pipes or other metallic structures. It is used as "+" pole in electric circuit rectifier-anode-soil-metal structure-rectifier. By appliance of such a current direction it is possible to avoid corrosion with a partial consumption of the anode. The anode composition meets ASTM A518 Grade 3 and BS 1591.

GEOMETRY

- anode "A1": 500 mm (length) x 50 mm (Ø)
- anode "A1": mass: 8 kg
- anode "A2": 1000 mm (length) x 50 mm (Ø)
- anode "A2": mass: 16 kg
- anode "A3": 1500 mm (length) x 50 mm (Ø)
- anode "A3": mass: 24 kg
- cable to anode sealing performed with epoxy resin
- M8 bolt

NOTE!
According to customer requirements,
anodes can be manufactured in other shapes and sizes.

COMPOSITION ASTM A518M Gr.3

ELEMENTS	COMPOSITIONS
SILICON (Si)	14,20 – 14,75 %
MANGANESE (Mn)	Max 1,5 %
CARBON (C)	0,7 – 1,1 %
CHROMIUM (Cr)	3,25 – 5 %
MOLYBDENUM (Mo)	Max 0,2 %
COPPER (Cu)	Max 0,5 %
IRON (Fe)	Balance

ANODE CONSUMPTION

In tests and real life installation, up to 99,8% of the anode material was consumed.
Typical consumption figure is 88% to 93,5%.

ENVIRONMENT	CURRENT DENSITY (Amp/m^2)	CONSUMPTION RATE (Kg/Amp - Year)
COKE BACKFILL	10 - 30	0,1
FRESH WATER	10 - 30	0,15
SEAWATER	10 - 30	0,5
SOIL	10 - 30	0,3

INSTALLATION

- according to design

CONNECTING CABLE

- PVC/PVC, XLPE/PVC, PVDF/HMWPE
- ≥ 1x10mm2 or 4x2,5mm2

FUNCTIONALITY CHECK

- yearly, measuring:
  - the anode ground bed resistance
  - the cathodic protection sufficiency

MAGNESIUM ANODE
TYPE MA

Magnesium anode is used as a sacrificial material in galvanic cathodic protection system. Due to its high driving voltage magnesium is an ideal protector for soil application. In order to increase conductivity anodes may be prepared filled with backfill in cotton bags. Backfill composure: gypsum (75%), bentonite (20%) and sodium sulphate (5%).

GEOMETRY

ANODE TYPE:	MA1	MA2	MA3	MA4	MA5	MA6
Anode dimension: (length x Ø mm)	**460x110**	**310x110**	**150x110**	**610x110**	**480x150**	**600x180**
Prepackaged anode dimension: (length x Ø mm)	**660x150**	**510x150**	**350x150**	**810x160**	**840x190**	**800x240**
Anode mass: (kg)	**7,8 kg**	**5,2 kg**	**2,6 kg**	**10,4 kg**	**14,5 kg**	**22,7 kg**
Prepackaged anode mass: (kg)	**15 kg**	**10 kg**	**5 kg**	**22 kg**	**30 kg**	**44 kg**

POTENTIAL

CHEMICAL COMPOSITION	OUTPUT ($Cu/CuSO_4$) HIGH POTENTIAL 1.75 V
ALUMINUM (Al)	**Max 0,01 %**
ZINC (Zn)	**-**
COPPER (Cu)	**Max 0,02 %**
SILICON (Si)	**Max 0,05 %**
MANGANESE (Mn)	**0,5 – 1,3 %**
IRON (Fe)	**Max 0,03 %**
LEAD (Pb)	**-**
OTHER IMPURITIES	**Max 0,3 %**
MAGNESIUM (Mg)	**Balance / Other**
CAPACITY (Ah / kg)	**1245**

INSTALLATION

– In soil – according design

CONNECTING CABLE

– type as PVC/PVC or XLPE/PVC ≥ 10 mm^2
– per client request

FUNCTIONALITY CHECK

– yearly, measuring:
  - the anode groundbed resistance
  - the cathodic protection sufficiency

NOTE!

No maintenance is required. In case of too high groundbed resistance or in case of cathodic protection insufficiency anodes need to be replaced.

MMO TUBULAR ANODE STRING

MMO (Mixed Metal Oxide) tubular anode string is assembled of cable and MMO Tubular anodes made of noble metals and their oxides applied on titanium basis (MMO anode). MMO Tubular anode composition meets ASTM B-338 Grade 1 Titanium. Anode acts as a "+" pole in circuit transformer / anode / electrolyte / cathode / transformer. By applying such current direction corrosion on metal construction is suppressed. Electric contact between cable and anode is performed by fitting and mechanical press. Connection is insulated by high-quality thermo-shrinkage hose.

STANDARD GEOMETRY

SIZE	DIAMETER (mm)	LENGHT (mm)	SURFACE AREA (m^2)
1	16	1000	0.050
2	25	500	0.039
3	25	1000	0.079
4	32	1200	0.101

MMO anodes are available according to specified standard sizes - however other sizes are available on special request.

CURRENT OUTPUT OF STANDARD ANODES:

ENVIRONMENT	MAX. CURRENT DENSITY	LIFETIME (YEARS)
CARBONACEOUS BACKFILL	50 A/m^2	20
CALCINED PETROLEUM BACKFILL	100 A/m^2	20
FRESH WATER	100 A/m^2	20
BRACKISH WATER	100-300 A/m^2	20
SEA WATER	600 A/m^2	20

Lifetime is dependent upon running at full output for the length of time. So in carbonaceous backfill the maximum current density is 50 A/m^2 which will give 20 years lifetime. If the anodes are operated at 25 A/m^2 then the lifetime will increase to 40 years.

INSTALLATION

- according to design (in soil/coke breeze/fresh water, seawater or mud/brackish water)

CONNECTING CABLE

- type as Kynar/HMWPE, EPR/CSPE

FUNCTIONALITY CHECK

- yearly, measuring:
  - the anode groundbed resistance
  - the cathodic protection sufficiency

NOTE!

- No maintenance is required. In case of too high groundbed resistance or in case of cathodic protection insufficiency anodes need to be replaced.

MMO COATED TITANIUM TUBULAR ANODE c/w CONCRETE ANCHOR

FUNCTION

MMO Coated Titanium Tubular Anodes c/w concrete anchor are used as anodes for Impressed Current Cathodic Protection of immersed structures, in sea water, brackish water or fresh water

INSTALLATION

– according to design (in soil/coke breeze/fresh water, seawater or mud/brackish water)

CONNECTING CABLE

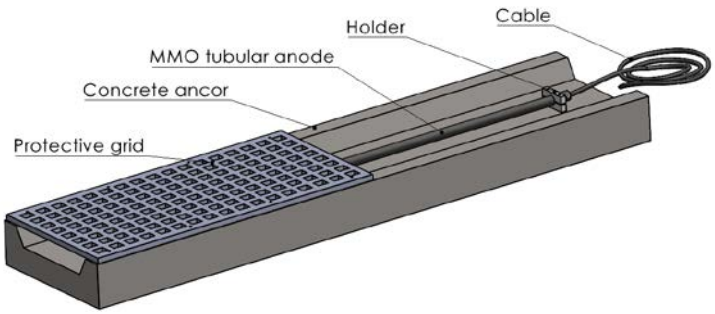
– type as Kynar/HMWPE, EPR/CSPE

FUNCTIONALITY CHECK

– yearly, measuring:

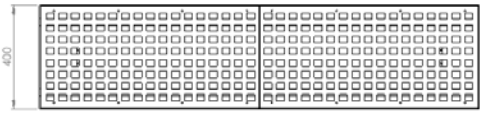
- the anode groundbed resistance
- the cathodic protection sufficiency

PARTS



BASIC DIMENSIONS

- As per drawing



GRAPHIC

MMO WIRE ANODE STRING

MMO (Mixed Metal Oxide) wire anode are copper titanium wire with a mixed metal oxide coating. MMO wire anode composition meets ASTM B-265 Grade 1 Titanium. The mixed metal oxide is a crystalline, electrically-conductive coating that activates the titanium and enables it to function as an anode.

Anode acts as a "+" pole in circuit transformer / anode / electrolyte / cathode / transformer. By applying such current direction corrosion on metal construction is suppressed.

Electric contact between cable and anode is performed by fitting and mechanical press. Connection is insulated by high-quality thermo-shrinkage hose.

STANDARD GEOMETRY

– wire anodes are manufactured in two diameters:
  - 1.5 millimeter
  - 3.0 millimeter

CURRENT OUTPUT OF STANDARD ANODES:

ENVIRONMENT	OUTPUT (A/m)		LIFETIME (YEARS)
	1,5 mm	3,0 mm	
METALLURGICAL COKE	0,25	0,5	20
PETROLEUM COKE	0,5	1,0	20
FRESH WATER	0,5	1,0	20
SAND	0,15	0,30	20
SEA WATER	3,0	6,0	20

Lifetime is dependent upon running at full output for the length of time. So in metallurgical coke the maximum current density is 0,5 A/m which will give 20 years lifetime. If the anodes are operated at 0,25 A/m then the lifetime will increase to 40 years.

INSTALLATION

– according to design (in soil/coke breeze/fresh water, seawater or mud/brackish water)

CONNECTING CABLE

– type as NYY, HMWPE (or per request)

FUNCTIONALITY CHECK

– yearly, measuring:
  - the anode groundbed resistance
  - the cathodic protection sufficiency

NOTE!

– No maintenance is required. In case of too high groundbed resistance or in case of cathodic protection insufficiency anodes need to be replaced.

CANISTER ANODE

Canister FeSiCr anode is made from galvanized steel canister which contains anode (wire, tubular or ferrosilicium) in backfill. Canister anode is constituent part of cathodic protection system of underground pipes or other metallic structures. It is used as + pole in electric circuit rectifier-anode-soil-metal structure-rectifier. By appliance of such a current direction it is possible to avoid corrosion with a partial consumption of the anode.

TYPE:

1. **"K1" 100 mm (Ø) x 1500/2000 mm (length)**
2. **"K2" 200 mm (Ø) x 1500/2000 mm (length)**
3. **"K3" 315 mm (Ø) x 1500/2000 mm (length)**

COMPOSITION OF A PRODUCT:

1. **Anode:** **- wire anode**
   type: - 1,5mm^2
   - 3mm^2
   - tubular anode
   type: - Ø16x1000mm
   - Ø25x500mm
   - Ø25x1000mm
   - ferrosilicium anode
   type: - A1 Ø50x500mm
   - A2 Ø50x1000mm
   - A3 Ø50x1500mm
   (Anode selection depends on technical requirements)
2. **Backfill:** **- metallurgical coke**
   - petroleum coke
   (Backfill selection depends on technical requirements)
3. **Canister:** **- galvanized steel**
   - various dimensions
   (Canister dimension depends on technical requirements)
4. **Cable:** **- PVC/PVC, XLPE/PVC**
   - ≥ 1x10mm^2 or 4x2,5mm^2
   (Cable type selection depends on technical requirements)
5. **Cable gland**

CATHODIC PROTECTION
MEASURING MANHOLE – MŠKZ

PURPOSE

The cathodic protection measuring manhole (MŠKZ) is used in industrial distribution centers, networks, wiring distributions, cathodic protection etc. It is used to connect cable distributions to the pipelines (connectors) and to install additional accessories (protective and compensating circuits, etc.).

FACTORY SPECIFICATIONS

GEOMETRY

- total diameter 500 mm (19.685'')
- opening diameter 435 mm (17.126'')

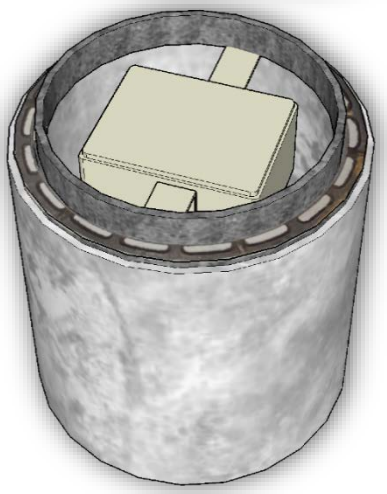
COMPOSITION

- gray casting
- concrete pipe
- connection box
- carriers

SPECIFICATIONS

FEATURES

- resistant to external environmental conditions
- lifetime over 10 years
- IP 54 protection



INSTALLATION MODE

- in ground – poured with concrete filling in plane with the top of the lid

MAINTENANCE

No maintenance.

METALLURGICAL COKE

Groundings and anodes performance in cathodic protection is enhanced by an increased selection of backfill that will provide a low resistivity ground.

GRANULATION SIZE:

- 0-4 mm
- 0-10 mm

AVERAGE CHEMICAL SPEC.:

- Moisture: 7,5 %
- Volatiles: 0,6 %
- Ash: 10,25 %
- Sulphur: 0,5 %
- Fixed C 83-90 %
- Resistivity (ohm cm) 50

PACKING.:

- In 25, 50 kg polyethylene bags
- Jumbo bags

Calcined petroleum coke is also available per customer request.

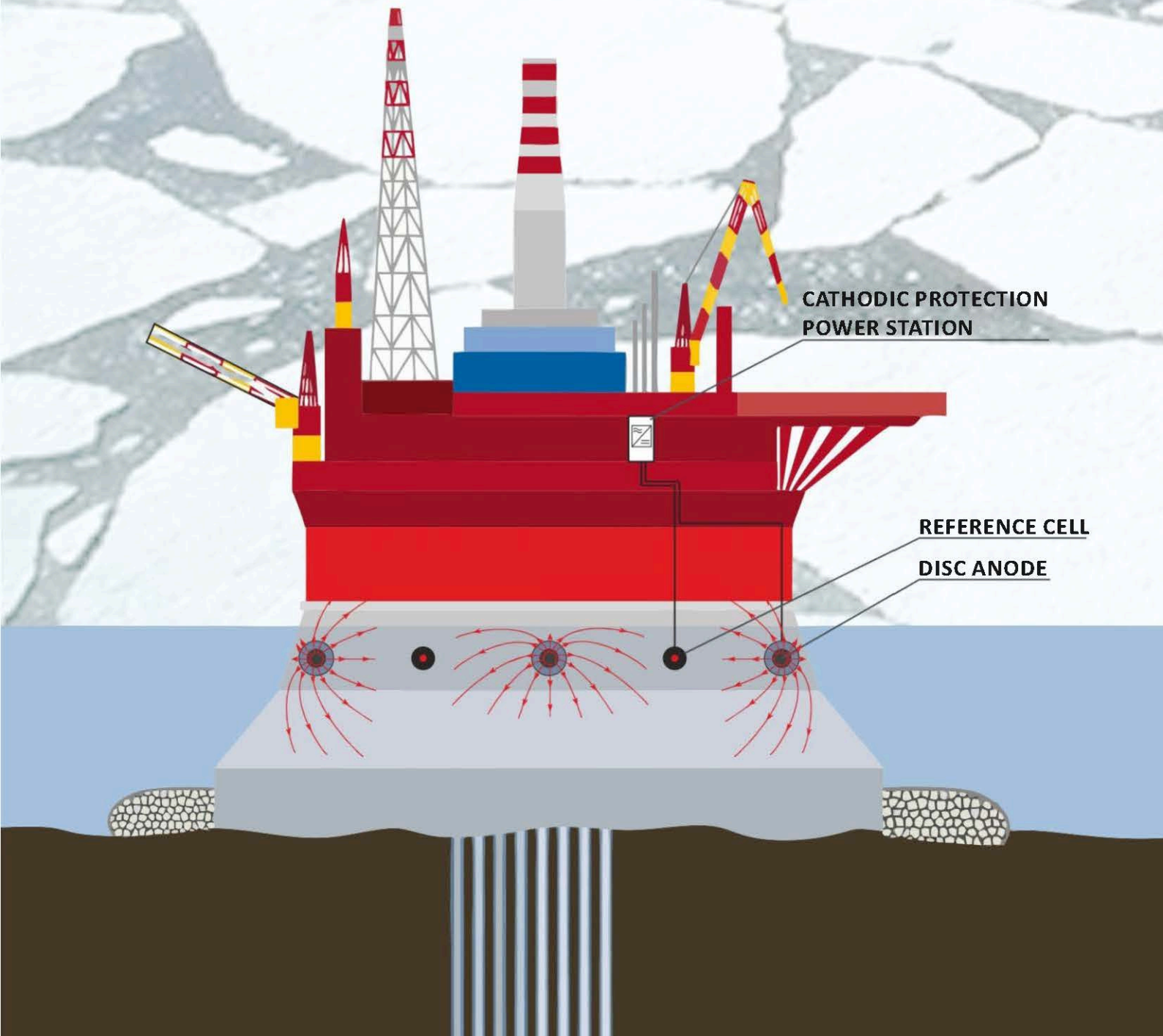
CATHODIC PROTECTION

PLATFORMS & SHIPS

ICE CLASS

GENERAL PRINCIPLE

Cathodic protection is corrosion protection technique that is effective for all embedded and/or submersed structures. In case of ships and platforms it will provide long life of the structure if properly designed and maintained.



KIT

Cathodic protection of platforms & ships consists of following major equipment:

1. Transformer/rectifier unit (power feed)
   - Provies a DC current flow from anode to cathode (structure)
   - May be of various output parameters depending on the platform surface

2. Disc Anode
   - Made of Titanium coated with iridium oxide to provide huge current load and geometrical stability during the years

3. Disc Reference Electrode
   - Sensitive element made of Zn or Ag/AgCl for voltage readings to determine whether Cathodic Protection current is sufficient

4. Offshore cable & cable junction boxes, assembly kit, cable carriers, negative junction, silicone...)

Transformer / rectifier unit (power supply)

Disc Anode

Disc Reference Electrode

SPECIAL ICE-CLASS PROGRAMME

For the regions of Caspian Sea and Arctic a special “ice-class” anodes and electrodes may be provided. These anodes, reinforced with top carbon fiber technology are strongest known material and can suffer tensile loads up to 750 MPa. Specially designed shield will keep active element protected from even highest loads while providing current flow at the same time.

CERTIFICATES

Equipment possesses CRS certificates.

HRVATSKI REGISTAR BRODOVA
CRS

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MARINE SOLUTIONS

CATHODIC PROTECTION

OFFSHORE PROGRAMME FOR:

BOATS, LUXURY YACHTS AND SHIPS

KIT

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Transformer/rectifier unit (power feed)

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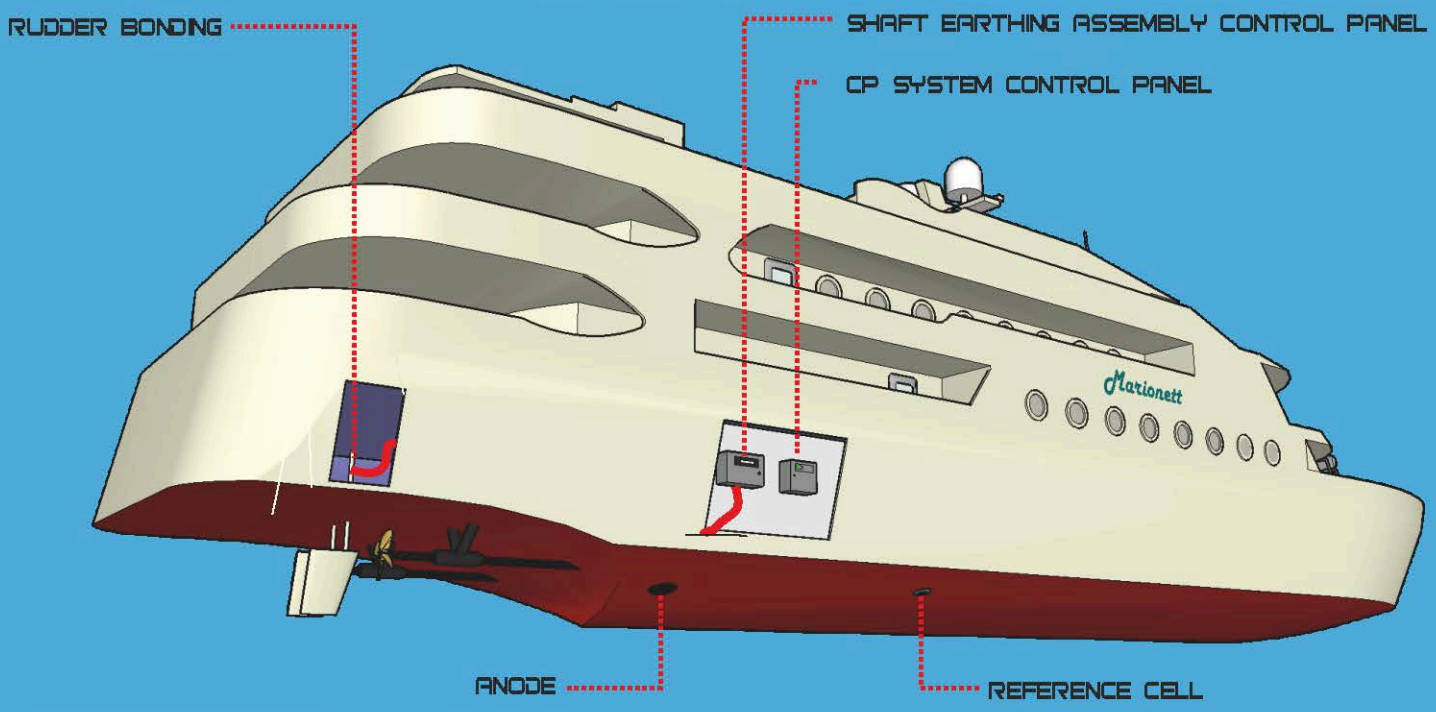

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CRS

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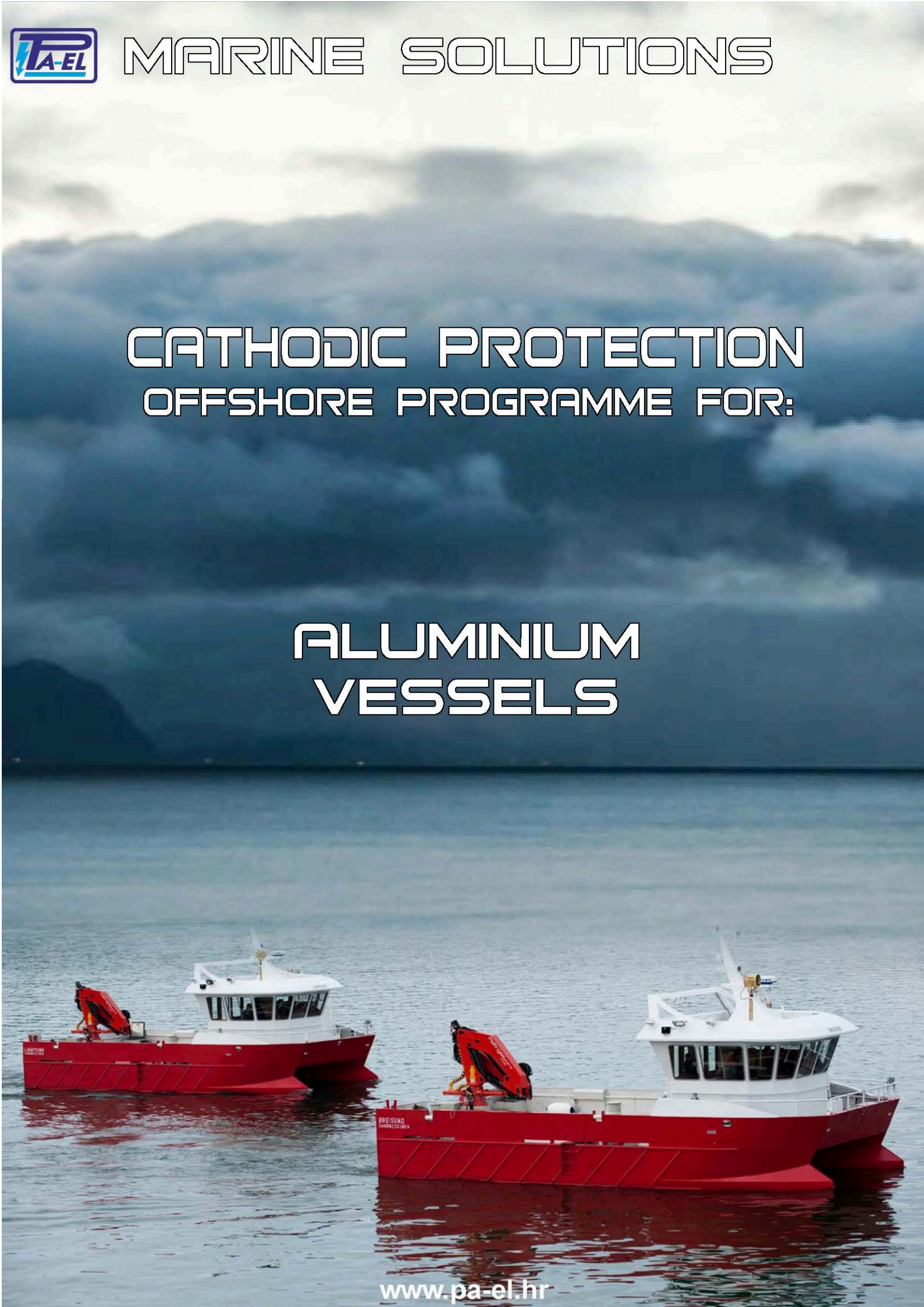
MARINE SOLUTIONS

CATHODIC PROTECTION

OFFSHORE PROGRAMME FOR:

ALUMINIUM VESSELS



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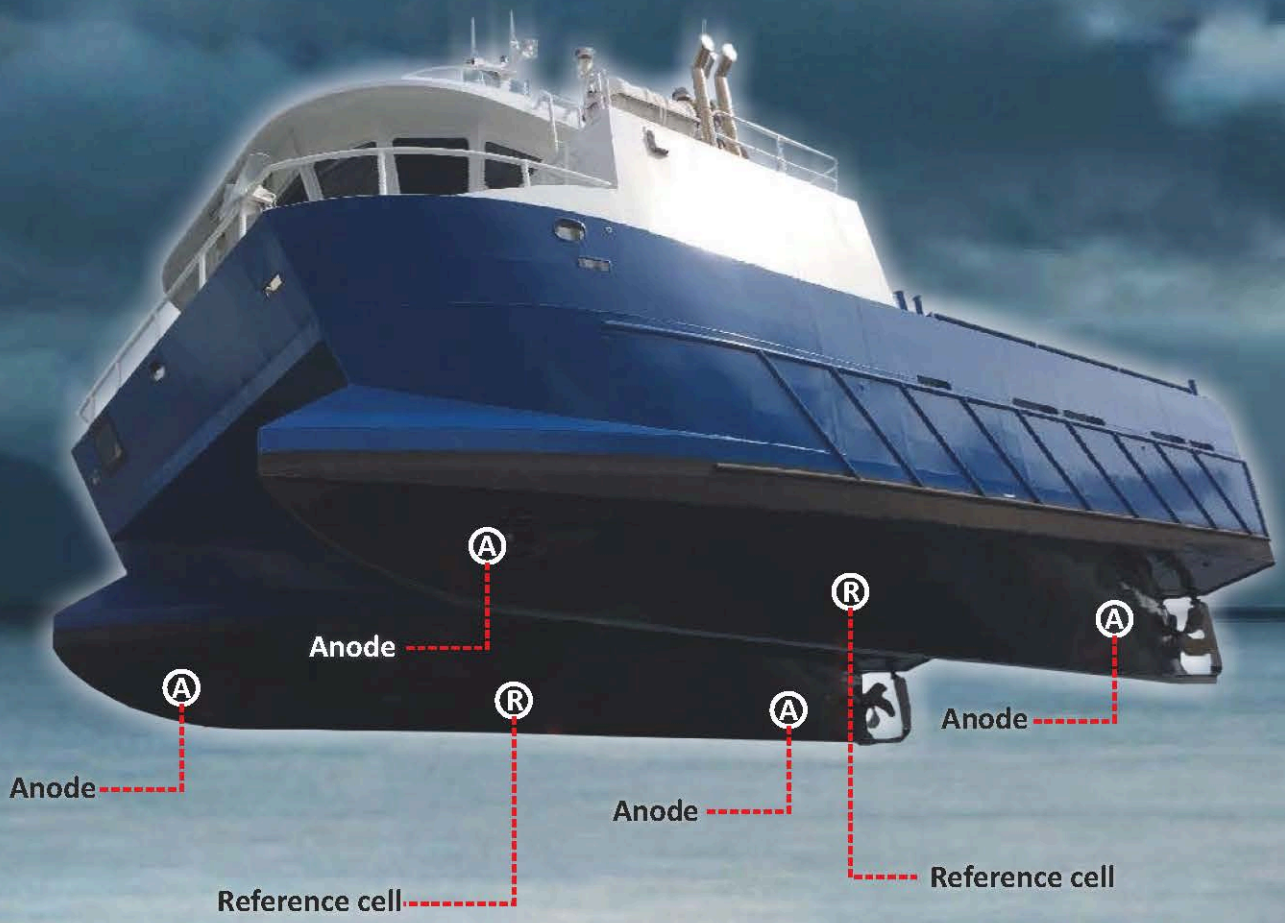
INTRODUCTION

The hull integrity of various vessels, no matter built from steel or aluminium, can be seriously affected by corrosion. Conventional protection with either zinc or aluminium anodes gives certain level of protection; however they need to be replaced at regular maintenance intervals. Furthermore, sacrificial/galvanic anode cathodic protection system (GACP) adds extra weight and spoils the hydrodynamic line of vessel.



PA-EL Marine Solutions is manufacturer of most advanced impressed current cathodic protection systems (ICCP) that requires no replacement of anodes - RODON 2000. Current drawn from the control panel travels through permanently installed non-soluble anode and hence, polarizes aluminium hull on protective potentials. Automatic regulation via installed reference electrode will allow exact and optimized amount of charge to prevent any corrosion occurrence. System is designed to operate for 30 years.

KIT

Cathodic protection of platforms & ships consists of following major equipment:

1. Transformer/rectifier unit (power feed)
   - Provies a DC current flow from anode to cathode (structure)
   - May be of various output parameters depending on the platform surface

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3. Disc Reference Electrode
   - Sensitive element made of Zn or Ag/AgCl for voltage readings to determine whether Cathodic Protection current is sufficient

4. Offshore cable & cable junction boxes, assembly kit, cable carriers, negative junction, silicone...)

Transformer / rectifier unit (power supply)

Disc Anode

Disc Reference Electrode

CERTIFICATES

Equipment possesses CRS certificates.

For your valuable Inquiry
and technical matter please
contact us at:

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49214 Veliko Trgovišće
CROATIA - EU

FAX: +385 (0)49 557 333
PHONE: +385 (0)49 557 333

E-mail: info@pa-el.hr

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BOILER PROTECT
Internal cathodic protection system

corrosion control for lifetime

PROTECT PROPERLY-PROTECT ONCE

BOILER-PROTECT system provides permanent and final protection against corrosion of boilers, tanks, heat exchangers, gas washers, reactors and other process equipment.


anode


electrode


cor. coupon

System lifetime: 30+ years (v_{corr} < 0.01 mm/year)

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INTERNATIONAL MARKETS

MAJOR CLIENTS

EVN

HEP

SIEMENS

tehnomont Brodogradilište PULA

JANAF

سوناطراك sonatrach

سونلغاز sonelgaz

SARAJEVOGAS

KONČAR

NIS

MONTER STROJARSKE MONTAŽE D.D.

plinacro d.o.o. OPERATOR PLINSKOGA TRANSPORTNOG SUSTAVA

CRODUX

BH-GAS

lng HRVATSKA

PSP PODZEMNO SKLADIŠTE PLINA

PARTNERS

Instruments for Trading Services Optimize your process انسترومينس للخدمات التجارية

STI الحلول التكنولوجية الصناعية Solutions Technologiques Industrielles

DCVG

NACE THE WORLDWIDE CORROSION AUTHORITY

MOBILTEX

Chemical Newtech

DE NORA

Digi-Key CORPORATION

T&R TINKER-RASOR.COM

TECHNICAL DATA SHEET

APS High Voltage Holiday Detector "Stick Type"

- Overground pipeline holiday detector
- Built for heavy field use in extreme environments
- Audible & visual indicators

PD Pipe & Cable Locator

- Underground pipeline detector & holiday detector
- Holiday detection on buried pipe (PD/H)
- Receiver loud speaker or headset use

RF-IT

- Uses Radio Frequency to test effectiveness of above ground insulation joints
- Analog display of results

CE-IT

- Uses Radio Frequency to test effectiveness of underground insulation joints
- Digital display of results

T-3 CP TEST STATION

- 13 hole terminal board
- Fits 3.5" OD riser pipe
- High impact and fire resistant

More information available at
https://www.tinker-rasor.com/

NOTES

NOTES

NOTES

12.2024.

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