Дистанционно управляем реклоузер ГВР в мрежи СН 22/35kV

Техническа документация

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Съдържание:

Увод

Прилижения:

Увод

Дистанционно управляема станция (DOU) е съоръжение за дистанционно управление на разположени навън прекъсвачи, реклоузери или на включвателни станции в разпределителни мрежи 25/38кВ - чрез GSM-GPRS комуникация от диспечерски пункт. Оборудването на централната диспечерска станция (CDS), както и GSM комуникационната мрежа в региона, е неразделна част от системата за дистанционно управление.

1. Дистанционно управление

Дистанционното управление използва комуникационна система GSM-GPRS.
Системата е защитена срещу случайни смущаващи сигнали, срещу интерференции и срещу статично електричество.
Комуникацията между централната станция и отделните дистанционно управляеми станции се осъществява чрез GSM-GPRS мрежа.

2. Централна и диспечерска станция (CDS)

Управляващото работно място на диспечера се състои от комуникационен център на базата на GSM-GPRS (на избрания оператор) и обща система за достъп. За управление и наблюдение на дистанционно управляемите станции е използвана система Siemens.

Тази високо ефективна софтуерна система позволява да бъде изобразено на екран актуалните статуси на дистрибуторската мрежа 22/35 Кв, както и реакция и намеса към нея от страна на диспечера посредством команди.
Всички отчетени работни състояния на отделните DOU, както и диспечерската намеса са записвани на запеметяващ информационен носител с възможност за печат под формата на служебни протоколи. Стандартно диспечера има на разположение данните за позицията на всеки реклоузер, прекъсвач (включен, изключен, междинно положение), за ръчно боравене с прекъсвача, за протичането на тока, за изправността на заземяването и затваряне на вратата, за състоянието на резервния акумулатор (подробности по-надолу).
Към диспечерския пункт също се предават текущите стойности на тока и напрежението от отделните етапи. Всички алармени съобщения се предават с обозначение за време и се записват в дневника на системата.

3. Дистанционно управляема станция (DOU)

Конструкцията на комуникационната и управляваща електроника е различна в зависимост от това дали се отнася за управление на реклоузер, на секторен прекъсвач или подстанция, и то както по отношение на механичната конструкция, така и по състава на функционалните електронни блокове.

3.1 Цялостно описание на дистанционно управляемия реклоузер ГВР
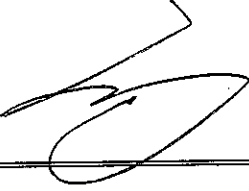
Окомплектоването на системите на дистанционно управляваните реклоузери по отношение на използването на приложения и внедряване на PPN се предлага в четири варианта:
  - Реклоузер ГВР PPN с помощна конзола и изолатори, хоризонтална линия (най-евтиният вариант) - виж Фиг 1а
  - Реклоузер ГВР PPN без конзола, хоризонтална линия - виж фиг 1б.
  - Реклоузер ГВР PPN с помощна конзола и изолатори, за преход към кабелната мрежа - виж фиг 1в.
  - Реклоузер ГВР PPN без конзола за преход към кабелна мрежа - Виж фиг 1г

Цялата система на свързване и монтаж на дистанционно управляемия прекъсвач GVR на бетонен стълб е показано на фигурите от 1а до 1в.
Пилонът ще да бъде оборудван с лека конзола с изолация VPA 135/1,2.
Прекъсвачът GVR (поз.1) е монтиран на стълб с помощта на две конзоли U8/ 400 mm и скоби за

закрепване 300/320 mm на височина около 7 метра над земята.

Линиите на входните и изходните полюси на прекъсвача на отделните фази са разделени с обтягащи изолатори DS-35G 38kV Fiberlink (поз. 3).

Всички фази на прекъсвача са защитени с ограничители на пренапрежение 25/38kV тип HDA 24NA. Три са монтирани директно върху прекъсвача GVR (страната в посока към натоварването), а останалите три са разположени на спомагателна конзола.

Срещу прекъсвача върху поставка (поз. 12) е прикрепен двуполюсен изолиран трансформатор VPT 25/38 (поз. 6). Неговата първична намотка се захранва от двете крайни фази на линията, свързани с ограничителите на пренапрежение, монтирани на конзолата.

Антената е изведена от шкафа през самостоятелен щуцер и е монтирана на спомагателна конзола с държач за антена на височина 4,5 м над земята.

Таблото на устройството за дистанционно управление (поз. 7) е прикрепено към стълба с помощта на две муфи (поз.19) на 0,9 метра от земята.

Връзката между прекъсвача и входящия клеморед в шкафа е направена от многожилен екраниран кабел (поз.15).

Кабелът от напреженовия трансформатор на прибора е изведен до шкафа на дистанционно управление чрез система от защитни тръби, маркучи и клеми (поз.14).

Втулките на реклоузерите ще бъдат осигурени със специални покрития от силиконова гума (защита срещу птиците).

Кабелът на реклоузера ще бъде тип 25/38-ADX-K (изолиран) със съответно сечение.

По-подробни описания и параметри за всяко от тези устройства са посочени в съответните им позиции.
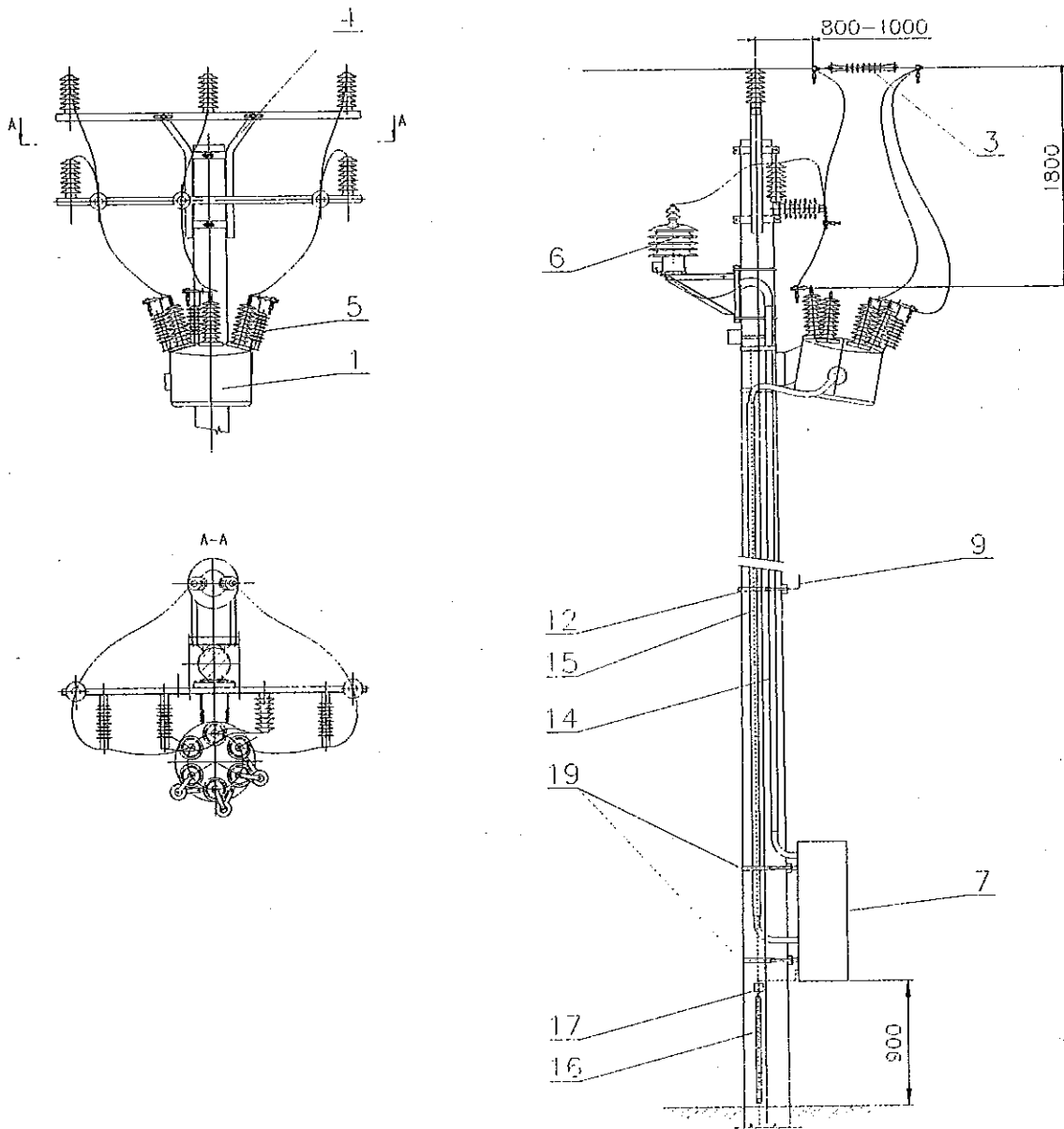
Фиг. 1а - Реклоузер ГВР с помощна конзола и изолатори, хоризонтална линия
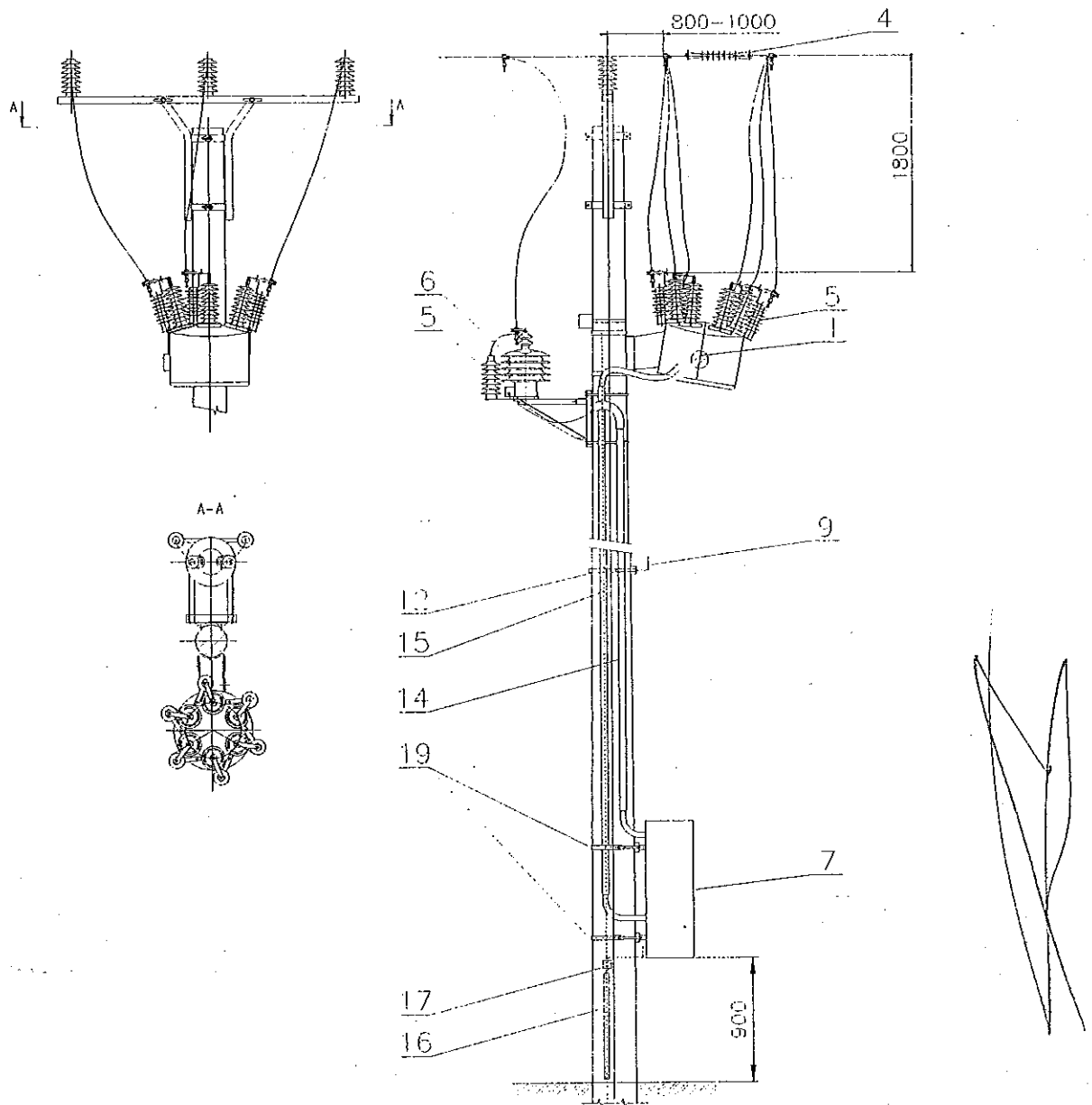
Фиг. 1б - Реклоузер ГВР PPN без конзола, хоризонтална линия
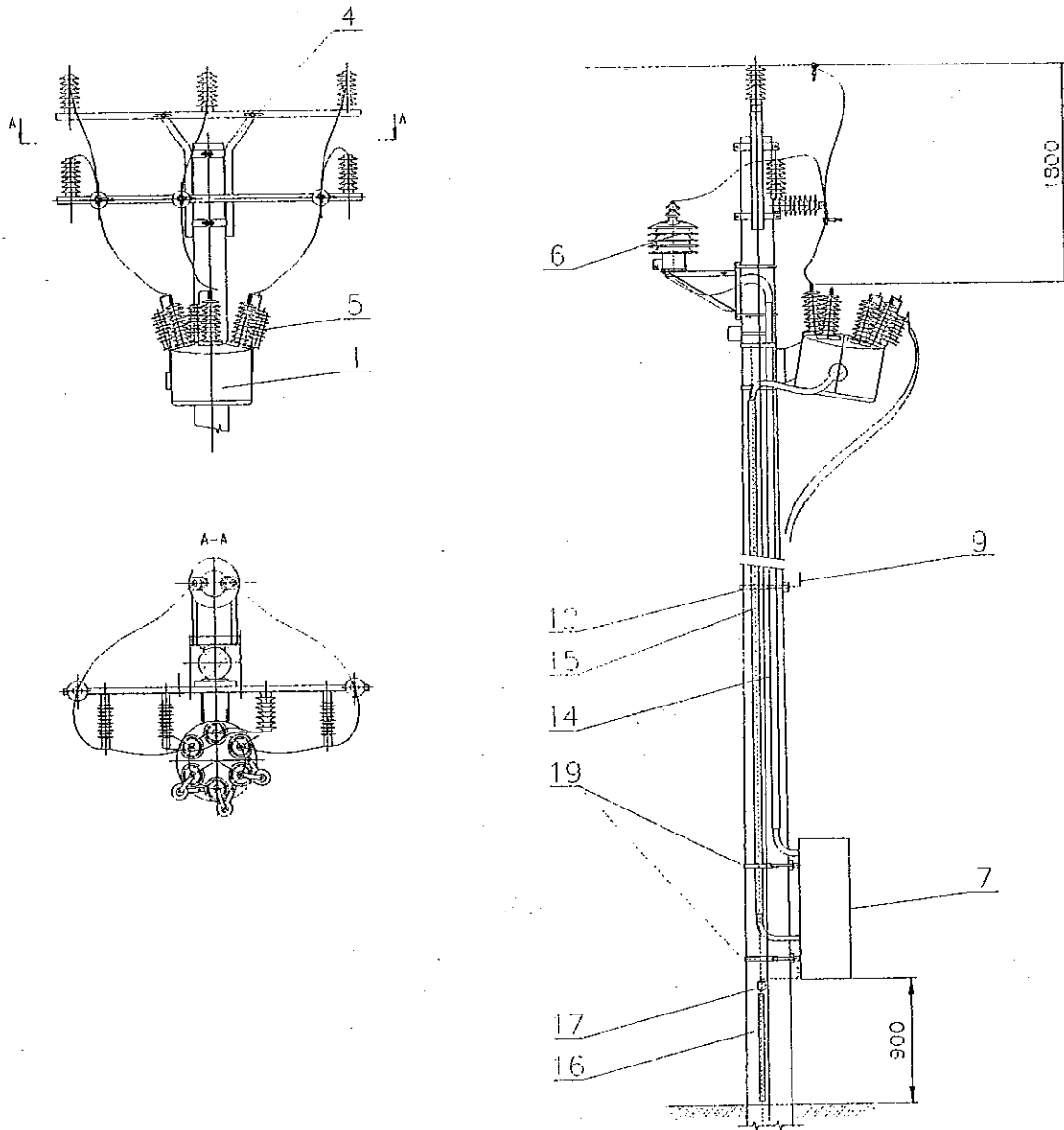
Фиг. 1в - Реклоузер ГВР с помощна конзола и изолатори, за преход към кабелната мрежа
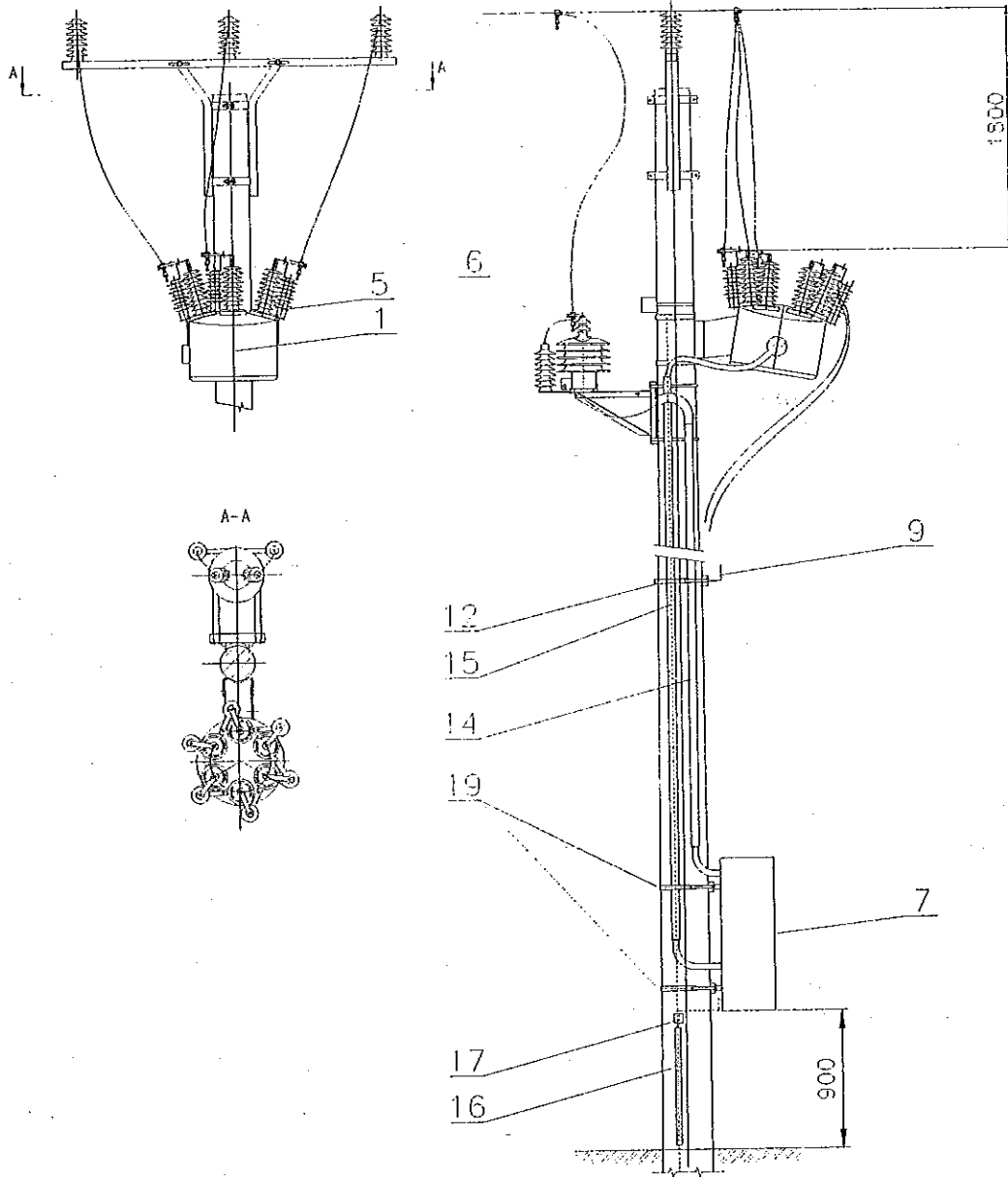
Фиг. 1г - Реклоузер ГВР PPN без конзола за преход към кабелна мрежа

Легенда към фиг. 1а, 1б, 1в, 1г, 1д

1 Прекъсвач GVR 27/12 (GVR 38/10)
2 Довеждане на захранване от напрежителната сист. 22/35kV към полюсите на прекъсвача
3 Изолатор за напрежение DS-35G Fiberlink
4 Лека конзола с подкрепящи изолатори
5 Ограничител на пренапрежение Reichem
6 Двуполюсен захранващ трансформатор VPT 25/38
7 Шкаф на дистанционното управление DOU 1111G-REC
9 Антена GSM
12 Държач на антената
13 Стъпала
14 Защитна пластмасова тръба UPR с кабел за захранване на шкафа на дист. управление
15 Свързващ кабел между прекъсвача GVR и шкафа със защита RTU 7M
16 Предпазна дървена лайсна
17 Измервателна клема
19 Скоби за монтиране на шкафа към стълба

3.2   Захранващи и измервателни трансформатори на напрежението VPT 25/38

Както вече беше отбелязано в точка 2.1, за захранване на шкафовете за дистанционно управление и за сигнализиране наличието на напрежение се използват външни двуполюсни трансформатори на напрежение VPT 25/38 KPB-Intra.
Преобразуването на напрежението в трансформатора е от 22/35kV на 100V с номинална мощност 150VA. Теглото на трансформатора е 54 кг.
По-подробна информация, включително чертежи с размери, са показани в придружаващата документация - приложение 4.

3.3   Реклоузер ГВР (Whipp & Bourne)

Превключвател с автоматично изключване, състоящ се от вакуумен прекъсвач и управляващ механизъм, който се съхранява в уплътнена алуминиева кутия. Тази кутия е изпълнена със серен хексафлуорид (газ SF6), служещ като изолационна среда, и същевременно като контролирана среда за електрическите и механичните компоненти.
Всички пускащи и спиращи операции се извършват във вакуумна камера, така че тук не възникват разпадащите продукти, причинени от електрическа дъга в газ SF6

Прозорчето, намиращо се също в долната част на тялото на прекъсвача, служи за контролиране на състоянието му.
Лостът, поставен в прореза на основата, позволява ръчно заключване на прекъсвача – чрез преместването му на около 45° надолу. Пружината държи лоста в долно, т.е. заключено положение дотогава, докато лостът не бъде върнат ръчно обратно до хоризонтално положение.
В заключено положение е прекъснато довеждането на управляващо напрежение към задвижването.

Управлението на прекъсвача се извършва с помощта на контактни пружини и магнитно задвижване, управлявано чрез еднопосочен импулсен ток.

Главни технически данни за външния прекъсвач	GVR 27
номинално напрежение	27 kV
импулсно издържащо напрежение	125kV
постоянен номинален ток	630 A
симетричен ток на изключване	12 kA
симетричен ток на включване	12 kA
асиметричен ток на включване	32 kA
коеф. за трансф. на осигуряващия трансформатор	200/1 A
клас на точност	5P10
коеф. за трансф на вградения токов трансформатор	1A/5mA
коеф. на натоварване на вградения токов трансформатор	0,15VA
пълнещо налягане на газта SF6	0,3 bar
номинално налягане на газ SF6	атмосферно
контролно напрежение на оловния AKU	60 – 90V DC
вътрешна работна температура	-40°C - +50°C
тегло	145 kg

Главни технически данни за външния прекъсвач.	GVR 38
номинално напрежение	38 kV
импулсно издържащо напрежение	150kV
постоянен номинален ток	630 A
симетричен ток на изключване	10 kA
симетричен ток на включване	10 kA
асиметричен ток на включване	32 kA
коеф. за трансф. на осигуряващия трансформатор	200/1 A
клас на точност	5P10
коеф. за трансф на вградения токов трансформатор	1A/5mA
коеф. на натоварване на вградения токов трансформатор	0,15VA
пълнещо налягане на газта SF6	0,3 bar
номинално налягане на газ SF6	0,3 bar
контролно напрежение на оловния AKU	60 – 90V DC
вътрешна работна температура	-40°C - +50°C
тегло	155 kg

Електрическата устойчивост е значително по-дълготрайна от изискваната според стандартите ANSI и IEC.

Управляващото напрежение е 60-90V DC, образувано е от специален капацитивен D63 с вграден автотестер.

По-подробни данни са посочени в приложение № 3.

3.4 Шкаф за управление на реклоузер DOU 1111G-REC (фиг. 2)

Шкафът DOU е конструиран за трудните условия за работа навън.

Той е заварен от стоманена ламарина с дебелина 2.5, степен на защита IP43. Повърхностното покритие е направено с горещо поцинкование (слой по-дебел от 120μm). Възможно е използването на шкаф от неръждаема стомана с дебелина 1.5.

Шкафът е конструиран така, че напълно да се предотврати преминаването на вода и насекоми в шкафа. Вентилацията на шкафа осигуряват специални вентилационни щуцери (отговарящи на IP43).

Горната стена на шкафа е направена като покривче предотвратяващо пряко проникване на дъжда при допирната част на вратата с шкафа.

На задната стена на шкафа се намира външна заземителна точка - винт M12. Осветлението в шкафа е зависимо от състоянието от статуса на контакта на вратата.

Шкафът има две независими врати със специални брави ABLOY с изискваната йерархия.

Вътрешните врати предотвратяват достъпа до системата за управление (генерален ключ), но позволяват всякакво управление от място.

Шкафът се монтира върху бетонен или дървен стълб с помощта на две обикновено използвани скоби и муфи.

Безопасността против манипулиране по време на монтажната работа върху захранването, се осигурява с катинар, с който се заключва външната врата.

Разпределението на отделните функционални блокове в шкафа е показано на фигура 2.

Основни технически параметри на шкафа за управление DOU на реклоузер

Разход	50 W
Работна температура	-25 до 60°C
Брой входове	10 цифрови
	3x3 аналогови (напрежителни, токови)
Брой изходи	5 релейни
Отделени входове и изходи	4,5 kV$_{st}$
Време на работа без захранване (със заредени батерии)	48 часа
Трайност на батерията	10 години
Тегло	28 kg
Защита	IP 43
Повърхностно покритие	горещо поцинковане

На монтажната лайсна, според схемата за свързване, се инсталират захранващи клеми, предпазители, контактори и източници.

Както вече бе отбелязано, за манипулация прекъсвачът GVR се нуждае от напрежение най-малко 60V DC. Това напрежение се осигурява от капацитивен източник D63.

    Входно напрежение: 24V DC (от AKU)
    Изходно напрежение: 90V DC, 20A

Източникът е снабден със сигнализация (релеен контакт) за спадане на напрежението под 60V и със съоръжение за авто-тестване.

За осигуряване при евентуална манипулация се използва автоматичен предпазител FA2.

Ако температурата в шкафа падне под 3 °C термостат (намиращ се в единица RTU 7) автоматично включва нагревател от 60 W (ET). Изключването на термостата и по този начин и на отоплението се осъществява приблизително при 8 °C. Данните за температурата се предават чрез системата GSM до диспечерския пункт.

На клемореда Х са прокарани захранващо, сигнализационно и контролно напрежение от прекъсвача и останалите вериги.

Клеморедът се състои от клеми, произведени от фирма Weidmuller:

WDU 2,5	обикновена, поредна
WTR 2,5	надлъжно разединителна
WTL 6/1 STB	токово разединителна

Входящите токове са доведени към защитите през токово надлъжно разединителни клеми с възможност за извършване на късо съединение на токовите вериги и включване на съоръжението за тестване.

В шкафа също така е възможно използването на захранващо напрежение от 24V DC за захранване съоръжението за тестване на защитата.
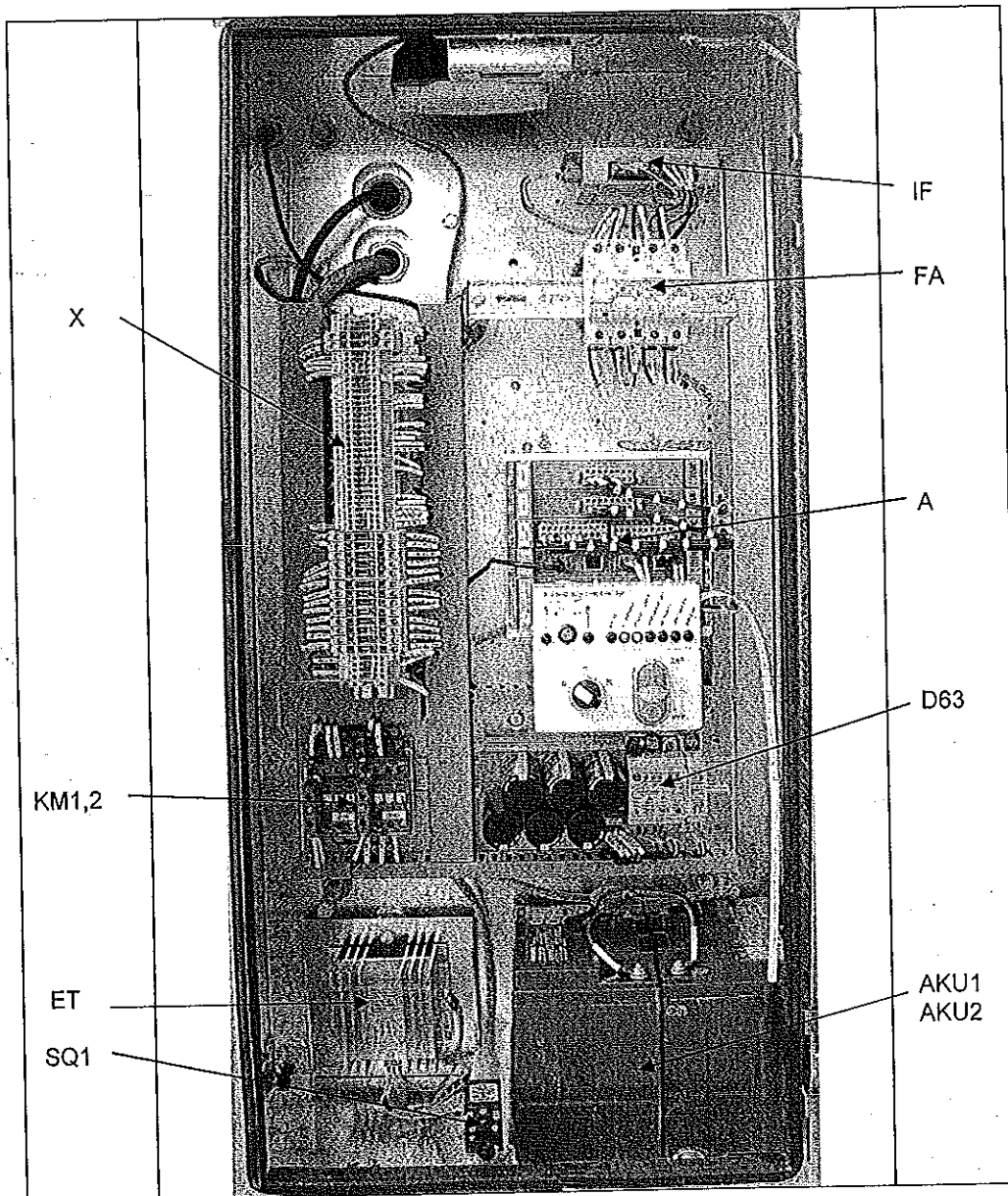
Фиг. 2 - Разположение на устройствата в шкафа на дистанционното управление DOR 1111G

ЛЕГЕНДА: A   - Управляваща единица RTU7M
            D63   - източник D63C – управляващо напрежение на реклоузера
            ET   - отопление
            SQ1   - краен включвател за индикация на отваряне на вратата
            KM1,2   - контактори
            FA   F1   - предпазител на веригата за отопление (вкл. токовата веригата за
                            осветление)
                     FA1 – предпазител на мрежовото напрежение
                     FA2 – предпазител на задвижването
                     FA3 - предпазител на зареждащата верига AKU
            SQ1   - краен включвател за отваряне на вратата
            AKU1, AKU2 на – гел акумулатори 12V, 28Ah Panasonic
            X – клеморед за захранващо, сигнализационно и контролно напрежение
            IF - интерфейс за измерване на фазови напрежения

DOU се захранва двуполюсно от изолиран СН трансформатор от напрежението на линията (виж Приложение 4).

Трансформаторът е монтиран върху стоманена конструкция, прикрепена към стълба над шкафа на DOU.

Директно на стълба е монтирана траверса, носеща насочена (ненасочена) антена, отводът на която влиза в шкафа и е съединен с контролната станция RTU7M. Към тази станция е трайно свързан управляващият модул, който осигурява обработката на получените телеграми от CDS и чрез своите входове и изходи извършва контрол и събиране на данни от DOU.

Важна роля от гледна точка на функционалността изпълнява защитата на единица RTU 7M от фирма ELVAC, разположена в дясната част на шкафа, по средата.

Сигналите доведени до модула преминават през електронна платка, съдържаща изолационни цифрови и аналогови преобразуватели с изолационно напрежение 4.5 kVst и помощни вериги.

Два резервни акумулатора позволяват DOU да работи без захранване в продължение на 48 часа, включително възможността за двадесет манипулации с реклоузера.
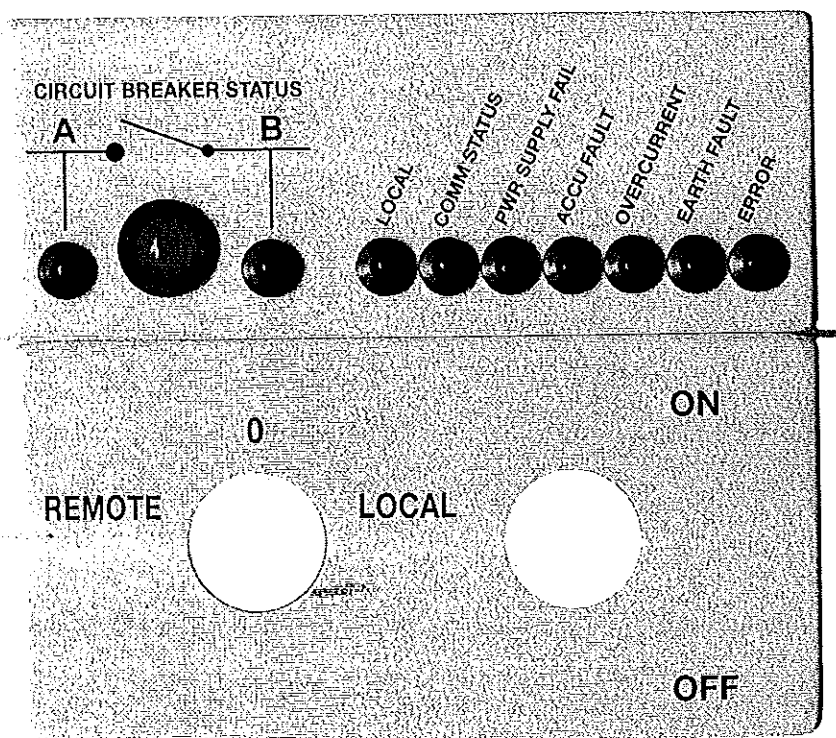
Фиг. 3 - Контролен и сигнализационен панел на шкафа за дистанционно управление DOU 1111G-REC

В долната част на контролния панел се намира превключвач „местно – дистанционно" и двоен бутон за включване и изключване на прекъсвача. В горната част на панела са разположени лед диоди за индикация на състоянието. Сигнализацията се управлява чрез процесор на панела за сигнализация и комуникира с единицата RTU7M по линия RS 485. Лед диодите могат да бъдат произволно програмирани, стандартно сигнализацията е настроена по следния начин:

Диод А сигнализира напрежението от страна на захранващия трансформатор - посока от разпределителя.
Диод В сигнализира напрежението в посока към натоварването.
Статус на разединителя (ключа) – зеленият цвят показва изключено състояние, червеният показва включено състоянието на ключа.
Останалите сигнализации са според описанието на панела.

Цялата система на шкафа DOR 1111G-REC за дистанционно управление на прекъсвачи и реклоузери бе напълно изпитана от гледна точка на електромагнитна съвместимост в ЕМС VTÚPV Vyskov.

3.5 Комуникационна и телеметрична система

За пълен контрол се използва интегриран единица GSM RTU7M. Тази единица включва:
а) захранваща карта PWRI57 BAT 24/10
б) комуникационна карта COMIO4 GSM-485
в) карта за цифрови входове и изходи DI10-DAM DO5-D
г) карта за измерване на напрежението AI-UA/2-I (диапазон на напрежение 0-2V AC)
д) карта за измерване на тока AI-I/10 (диапазон на тока 0-10mA AC, претоварване 40mA AC)
Всякакви настройки на единицата се извършват през програма „Център на потребителя", за която фирма Elvac предоставя безплатен лиценз, който позволява свързането само към една единица в определен момент.

3.6 Защита на RTU7M (ELVAC)

Цифровата защита на единицата RTU7M е многофункционална защита, която е предназначена за реклоузери серия ГВР, ОСМ и други устройства, способни да измерват изискваните стойности. Възможно е да бъде използвана за СН изводи както за кабелни, така и за външни линии, и то в мрежи изолирани, компенсирани или съпротивително заземени.
Защитата ELVAC съдържа много защитни функции, програмно избираеми. Виж приложение номер 6 „Документация за защити"

Защитата може да се настрои дистанционно чрез Центъра на потребителя. Възможно е и локално настройване чрез Центъра на потребителя след свързване с единицата чрез Ethernet.

В случай, че е задействана защитата, командата ще бъде изпълнена само при положение че ключът „местно-дистанционно" е в положение **Дистанционно**, при изключен автоматичен прекъсвач на управляващото напрежение или превключване на положение местно, всякакъв вид управление е **блокирано**.
В разпределителните мрежите ще бъдат използвани защитните функции, описани в следващата таблица

Функция	Забележка
Свръхтокова защита	
Защита срещу късо съединение	
Насочена заземителна защита wattmetrick	
Повторно вкл.	

3.7 Списък на алармените съобщения и команди

Както вече беше споменато, система за управление RTU7M разполага с 10 цифрови входа, 5 релейни изхода, 6 аналогови входа.
Алармените данни, предавани на диспечерския пункт, са показани в таблицата по-долу

Функция	IEC адрес	Тип IEC	Тип RTU	RTU	Описание
f1/2uvr	250	46	COM	DO2/DO3	команда към реклоузерг (изкл / вкл)
f1/2OZr	270	45	COM	система	команда за блокиране на автоматиката повторно включване (изкл / вкл)
f3/4uvr	257	3	DI	DI0/DI1	сигнализация на статуса на реклоузера (изкл / вкл / междинно положение / повреда)
f4OZr	275	1	SI	система	сигнализация на статуса за блокиране на автоматиката за повторно включване (изкл / вкл)

f4douv	260	1	SI	DI3	сигнал от превключвателя за управление
f4skrin	262	1	SI	DI4	сигнализация за отваряне на шкафа
h1uv	272	1	SI	система	задействане на защитата от късо съединение
h2uv	271	1	SI	система	задействане на свръхтоковата защита
h32uv	273	1	SI	система	задействане на насочената заземителна защита
h35uv	276	1	SI	система	задействане на автоматиката за повторно включване
h40puv	264	1	SI	DI5	изключване на предпазителя на управлението
h40uv	274	1	SI	DI6	неподготвеност за управление
h51uv	259	1	SI	система	поднапрежение на батерията
h62uv	268	1	SI	система	липса на захранване от MTN – захранване на съор. RTU
	263	1	SI	DI2	изключване на предпазителя от акумулатора
	20	13	AM	система	стойност на капацитета на акумулатора
	18	13	AM	система	стойност на напрежението на батерията
	23	13	AM	система	стойност на напрежението на източника
IA/L2	19	13	AM	система	стойност на фазовия ток L2
UV/L1	518	13	AM	система	стойност на фазно напрежение L1
UV/L2	519	13	AM	система	стойност на фазно напрежение L2
UV/L3	520	13	AM	система	стойност на фазно напрежение L3
UV/V	17	13	AM	система	стойност на междуфазовото напрежение L12
UW	20	13	AM	система	стойност на активната мощност
UVAr	21	13	AM	система	стойност на реактивната мощност

4. Обслужване на системата на дистанционно управлявания реклоузер

По-долу посочените коментари относно обслужването, осигуряването на работното място и т.н. са създадени на базата на опита, получен при инсталиране на дистанционно управлявани прекъсвачи, реклозери и подстанции в предишни години.

4.1 Отваряне на вратата на таблото DO

Отваряне на вратата на таблото DO на реклозера, намиращ се навън, би трябвало да бъде разрешено само след одобрение от страна на диспечера на RD. Когато съобщението за отваряне на вратата на таблото DO е подадено към диспечерския център без предварително предупреждение, отварянето се счита за вникване на неоторизирани лица.

4.2 Манипулиране

Манипулирането (включване или изключване) с дистанционно управляемия секторен реклозер се определя от позицията на превключвателя, снабден с ключ: Д (дистанционно) / О (блокиране на управлението) / М (местно).
Манипулирането може да се изпълнява по следните три начина:

а) Дистанционно от диспечерския пункт - условието е, превключвателя на статуса Д /0 /М да е в позиция "Д" – дистанционно (от разстояние). При настройка "М" / местно - изпълнението на командата е блокирано от електрониката на таблото

б) Местно, директно с помощта на бутон, намиращ се в таблото за дистанционно управление, с бутон ИЗКЛЮЧИ или ВКЛЮЧИ. Ако превключвателя Д /0 /M е в позиция "Д" дистанционно , манипулирането с помощта на бутони е блокирано от електрониката на таблото

в) Ръчно - само изключване, с помощта на изолиран прът се завъртва жълтия лост на реклозера с 45°градуса. Това може да бъде извършвано при всички позиции на превключвателя за режим на работа.
В позицията на превключвателя "0" манипулирането с помощта на бутони и от страна на диспечерския пункт е блокирано.

4.3 Осигуряване на работното място

Осигуряването на изключения, дистанционно управляем реклозер се извършва по следния начин:
1) След изключването на реклозера превключвателя МЕСТНО – ДИСТАНЦИОННО –
БЛОКИРАНЕ се поставя в позиция блокиране на управлението „0"
2) Да се изключи автоматичния предпазител FA2 (16A) на контурите на задвижването
3) Таблото DO да се заключи с предназначените ключове.
4) С помощта на изолационен прът Lopour & syn чрез издърпване на лоста в долната част на изключвателя и неговото завъртване с 45° градуса в посока надолу направете РЪЧНО БЛОКИРАНЕ

4.4 Измерване на заземяването

Измерване на съпротивлението на заземяването и разединяване на пробната заземяваща клема е разрешено да се извършва само при липса на напрежение в кабелната линия.
Необходимо е да се измери както заземителя така и импеданса на природното заземяване на стълба. Това ограничение не се прилага, когато таблото е захранвано от двуполюсен трансформатор.

4.5 Смяна на акумулаторите

Смяна на акумулаторите може да се извършва само при напълно изключване от системата. Необходимо е да се спазва следната последователност:
1) Изключете автоматичния предпазител FA1 (6A) на линейното напрежение
2) Изключете автоматичния предпазител FA3 (6A) на кръга за зареждане на акумулаторите AKU
3) Развържете всички клеми на акумулаторите и извършете тяхната подмяна.
След смяната на акумулаторите включете автоматичния предпазител FA3 и след това възстановете линейното напрежение като включите автоматичния предпазител FA1.

5. Инсталация на реклоузер ГВР и настройка на системата за дистанционно управление

5.1 Инсталация и настройка на дистанционно управляемия Реклоузер ГВР

Инсталация и настройка на дистанционно управляемия реклоузер ГВР се извършва по следния начин:
- Първо, на стълба се монтира лека конзола - виж фигура 1а-1г
- Към конзолата се свързват проводниците за високо напрежение с помощта на изолатори FiberLink 35kV, отдалечени на 0,8 - 1,0 метър от центъра на колоната - виж Фигура 1.
- реклоузерът е монтиран на външната страна на конзолата още на земята с помощта на подпожки с проводници за пренапрежение Raychem
- На стълба се монтира държач със захранващ трансформатор VPT 25/38 (на страната на източника) с помощта на две конзоли и специален държач за реклоузера (от страната на консуматора) съгласно фигура 1.
- На долната част на стълба под реклоузера се монтира таблото на дистанционното управление според точка 5.4
- Защитата от пренапрежение се свързва към кабелната линия както е показано на фиг.1а-1г.
- Страната на високо напрежение на трансформатора ще бъде свързана към крайната фаза на кабелната линия за високо напрежение

- Реклоузерът, разрядникът, трансформаторът и таблото се свързват към проводника за заземяване според фигура 6
- Извършва се монтаж на кабела между трансформатора, реклоузера и таблото за дистанционно управление, кабелите са поставени в защитна тръба
- Извършва се контрол на заземяването и се измерва стойността на неговото съпротивление
- Пълно оживяване и тестване на таблото според точка 5.6

5.2 Свързване на трансформатора

Отделните проводници се свързват към клемореда след отваряне на корпуса на трансформатора VPT 25/38, според по-долу посочената таблица и според типа на кабела.

КАБЕЛ - ТИП	Жица (О)
клема „а"	Черна
клема „б"	синя

Кабел - тип: NYY-O 2x1,5

Кабелът е инсталиран с помощта на система от твърди DO а гъвкави тръби и свързва трансформатора към таблото DO, виж фиг. 1 .
В таблото на дистанционното управление жилите на кабела да се свържат към клемореда X1: 1 – проводник от клема "а" (черен) и от клема "б" към синята клема X1: 2.

5.3 Тестване на цялата система за дистанционно управление на реклоузера

След инсталиране на всички компоненти на дистанционно управлявания реклоузер и проверката за GSM връзка трябва да бъде направено пълно тестване на всички функции на място и при връзка с диспечерския пункт.

По-долу е посочена последователността на действия:
a) Превключвателя поставяме в позиция „Местно" и изпробваме командите OFF и ON.
   Уверете се, че не може да бъде дадена команда при изключен автоматичен предпазител на управляващото напрежение и при настройка на превключвателя в позиция „Дистанционно".
   Следва контрол за правилно сигнализиране върху панела на автоматизацията („местно – дистанционно" няма наличие на помощно (захранващо) напрежение за зарядното устройство и т.н.).

б) Превключвателя поставяме в позиция „Дистанционно" и с помощта на диспечера тестваме всички команди
   - Прочитане на данни от реклоузера (въпрос) - проверка на фактическите данни
   - Включване и изключване на ключа.

   При всички настройки да се направи контрол на сигнализираните статуси

в) Да се извърши проверка за правилно подаване на сигнализация към диспечерския пункт:
   - Местно – Дистанционно (превключвател за избор на управление)
   - Контролно напрежение (автоматичен предпазител FA2)
   - Отваряне на врата на таблото на дистанционното управление
   - Преминаване на свръхток във всяка фаза поотделно (с помощта на тестер)
   - Заземяване (с помощта на тестер DRIBO)
   -

г) изпробване изключване на ключа посредством токова защита (с помощта на тестер DRIBO)

д) изпробване изключване на ключа и повторно включване посредством функцията за защита от късо (с помощта на тестер DRIBO). Симулиране на успешно и неуспешно повторно включване .

е) И при двата случая да се контролира сигнализацията в диспечерския пункт, за да се разбере коя защита е била изключена и броя на повторните включвания .

ж) След включването на линията да се повери сигнализацията за липса (наличие) на помощното зареждащо напрежение и намален капацитет на акумулатора AKU

5.4 Описание на процедурата за отстраняване на неизправности

По-долу са посочени възможни неизправности, които могат да възникнат в системата за дистанционно управление и упътване за отстраняването им. Списъкът се основава на практически опит.

а) Съобщена повреда за загуба на линейно напрежение, или след продължително време спад на напрежението на батерията или пълен срив на станцията - прекъсване на комуникацията:
На захранващата карта RTU7M не свети мрежовата LED лампа PWR:
- Проверете автоматичния предпазител (прекъсвач) FA1 - евентуално да се включи
- Измерете напрежението на клемите на прекъсвача FA1 (приблизително 100V AC). Ако няма напрежение, проверка на захранването от инвертори и функционалността на прекъсвача: Дефектен инвертор или линия без напрежение - съобщение за неизправността

В случай, че зареждащият източник дълго време не е използван и по този начин батерията е изтощена, въвеждането на системата в ход може да отнеме няколко минути.

б) Съобщение за неизправност относно комуникацията между реклозера и диспечерския пункт
- Проверете захранването на единицата RTU 7M
- Проверете дали е правилно монтиран конектора на антената и дали антената е поставена правилно
- Извършване на замяна на единицата RTU 7M

в) реклоузерът не може да се управлява от диспечерския център (комуникационната връзка е наред)
- Уверете се, че превключвателят „ местно - дистанционно" е в позиция "Дистанционно" (това съобщение трябва да бъде контролирано от оператора в диспечерския пункт)
- Да се повери дали автоматичният предпазител FA2 не е прекъснал захранването – контролно напрежение (диспечерът би трябвало да провери статуса)

г) С реклоузера не е възможно манипулирането дори при местен режим на работа.
- Проверете състоянието на капацитивния източник D63, измерете неговото контролно и захранващо напрежение. Изходното (контролно) напрежение би трябвало да е около 95V DC, захранващото напрежение 24V DC. Ако капацитивният източник има контролно напрежение а не е възможно управлението – следва да уведомите доставчика Дрибо (Dribo).

д) Грешна сигнализация на някое от съобщенията, подадени към диспечерския пункт:
- Всяко алармено съобщение разполага със собствен вход. Статусът на дадено съобщение е сигнализиран посредством напрежение на входа на системата за управление , тип RTU. В случай на промяна на статуса (затваряне на вратата, изключване на автоматичния предпазител на управлението и т.н.) напрежението трябва да се промени от 0 V на 24V и обратно. В случай, че напрежението се променя, повредата е в съответния цифров вход.
- В противен случай, търсете повредата в затварящите контакти на сензорите, подаващи съобщения – крайни изключватели на вратите, помощни контакти на автоматичните прекъсвачи, превключвателите за режим на работа местно – дистанционно и т.н.

е) Грешна сигнализация на статуса на реклоузера
- повредата може да бъде в единицата на цифровите входове на системата за управление RTU - виж подточка д) – трябва да се сменят.

6. Технически параметри на шкафа DO (DOU1111G-REC) и мерки за безопасност

Таблото за дистанционно управление е специално конструирано от гледна точка на механично и електронно управление на външни реклозери (изключватели) и гарантира всички наредби и изисквания по безопасност (управление, обезпечаване на работното място и т.н.) относно дадената апликация.

Таблото DOU 1111G-REC е тествано за електромагнитна съвместимост в акредитирана лаборатория VTÚPV Вишков.

Технически параметри:

Размери:	525/38 x 1000 x 230 mm (Ш x В x Д)
Захранващо напрежение:	1 + N + PE 50Hz, 100V / TN-S
Номинално напрежение на таблото:	100V
Номинален ток:	6A
Номинална честота:	50Hz
Управляващо напрежение:	90V DC PELV
Сигнално напрежение:	24V DC PELV
Ниво на защита:	IP43

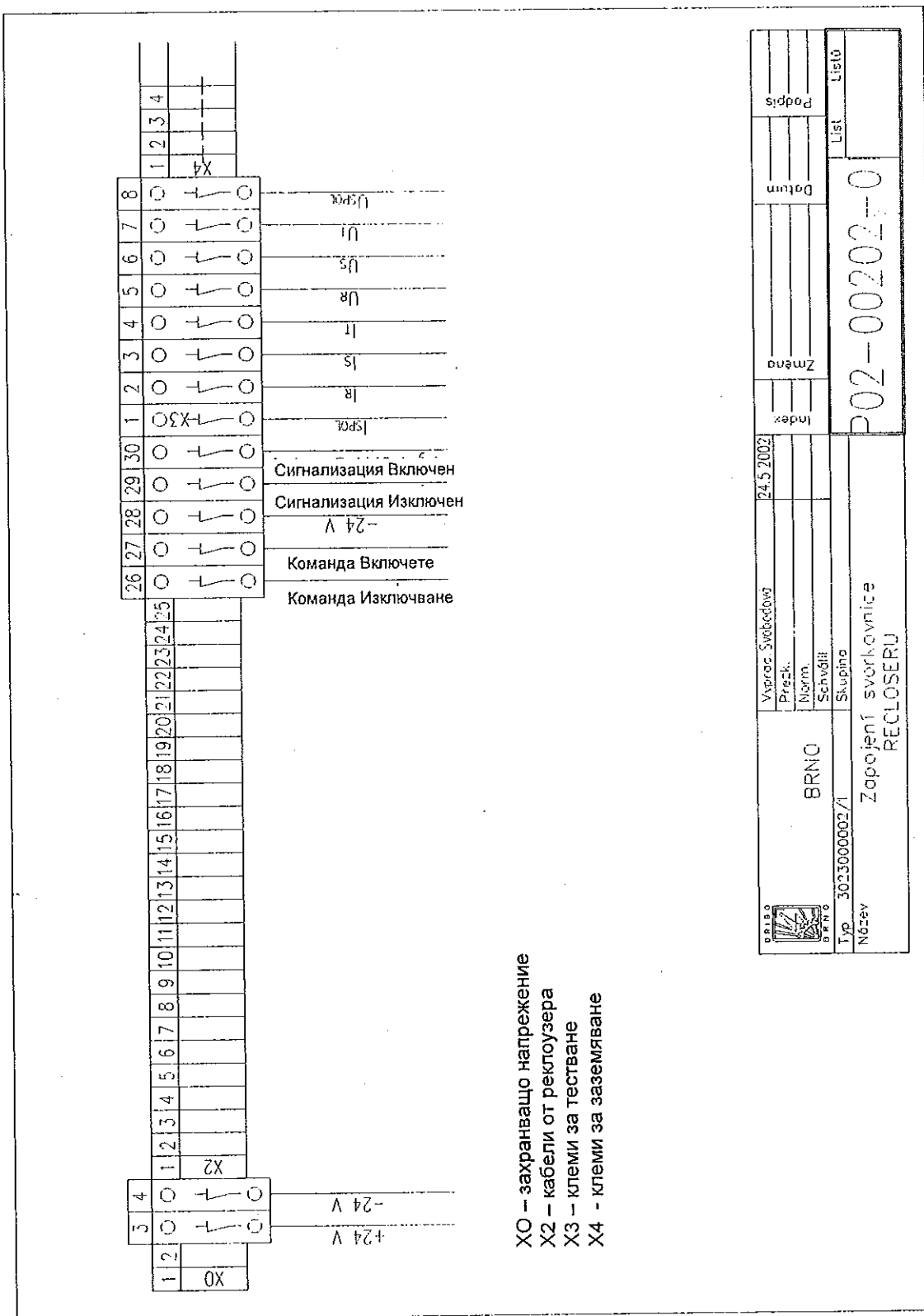## 7. Табло DO (DOU1111G) - Техническата документация

Списък на приложените документи:

- Спецификация на основните (резервни) части за таблото DO
- Таблица на свързването на таблото DO
- Клемни кутии на дистанционното управление на реклоузера
- Свързване на компонентите на таблото DO и заземяването
- Блок- схема на таблото DO
- Обща схема на свързване на таблото DO

Спецификация на основните части на таблото DO

Означ.	НАИМЕНОВАНИЕ	ТИП	КОЛИЧЕСТВО
			Бр.
A	Контролна единица GSM-GPRS	RTU7M	1
D63	Капацитивен източник на управлението на реклозера	D63C	
AKU 1,2	Гел батерия, Panasonic	LC-X122/358AP	2
ET	Отопление 60W	T100	1
X1,X4	Клеморед захранване	WDU 2,5	1
X2,X3	Клеморед на цифрови и аналогови входове	WDU2,5, WTL 6/1/STB	1
SQ1	Краен изключвател	FR-502 Pizzato	1
FA1	Автоматичен предпазител 1-полюсен 6A	LSN 6C/1	1
FA2	Автоматичен предпазител 1-полюсен 16A	LSN 6C/1	1
FA3	Автоматичен предпазител 1-полюсен 6A	LSN 16C/1	1
F1	Автоматичен предпазител 1-полюсен 4A	LSN 4C/1	1

Сигнализация Включен

Сигнализация Изключен

~24 V

Команда Включете

Команда Изключване

+24 V

-24 V

ХО – захранващо напрежение
Х2 – кабели от реклоузера
Х3 – клеми за тестване
Х4 - клеми за заземяване

P02-00202-0

BRNO

Zapojeni svorkovnice
RECLOSERU

Vyprac. Svobodova   24.5 2002
Preck.
Norm.
Schvatil
Skupina

Typ 3023000002/1
Název

Фиг. 5 – Клеморед на таблото за дистанционно управление

Components connection
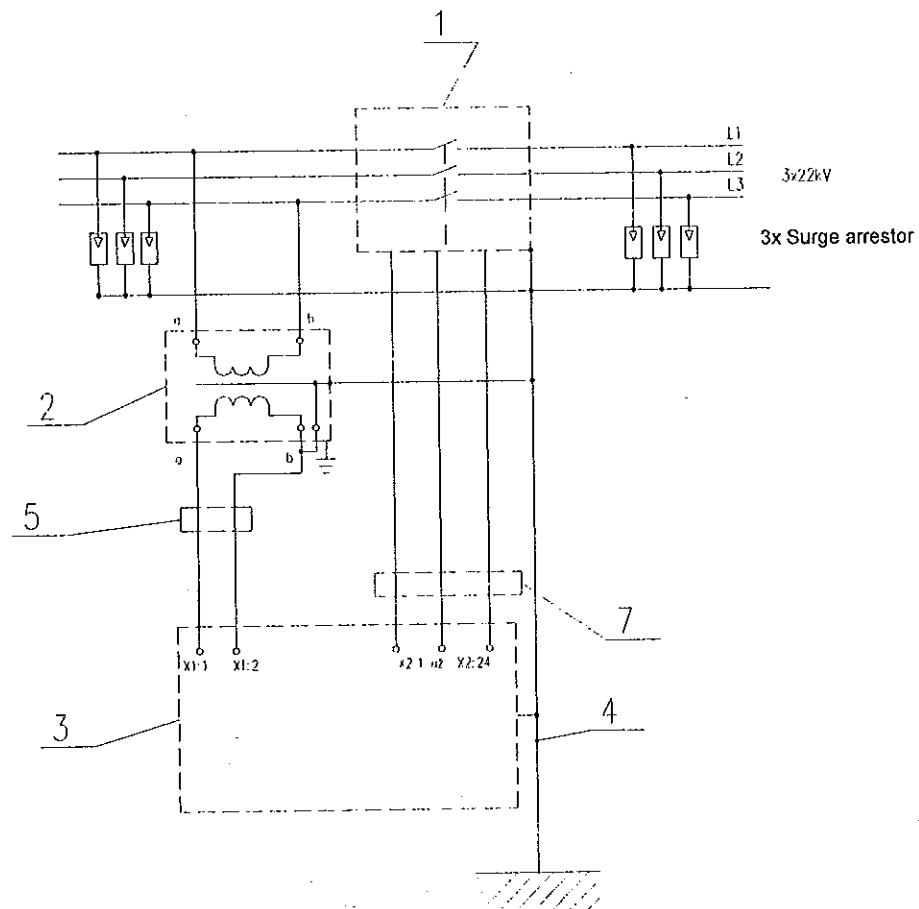
1- РЕКЛОУЗЕР ГВР 27
2- ИНВЕРТОР НА НАПРЕЖЕНИЕ 22кВ/57,6кВ
3- ТАБЛО DO DOU 1111R – REC
4- ЗАЗЕМЯВАЩО ВЪЖЕ
5- КАБЕЛ
6- ВКЛЮЧВАТЕЛ НА ПОЗИЦИЯТА НА РАЗЕДИНИТЕЛЯ
7- КАБЕЛ

Фиг. 6 – Свързване на компонентите на DO и заземяване

From Recloser   100/√3 V

X2
1–24

X4
1–4

X1,X5

PE   Earthing
       terminal

Local
control
block

I/O Unit RTU7M

Power supply
D63C

5,6

Recloser control
block

KM1: 53
KM2: 53

AKU 1   AKU 2
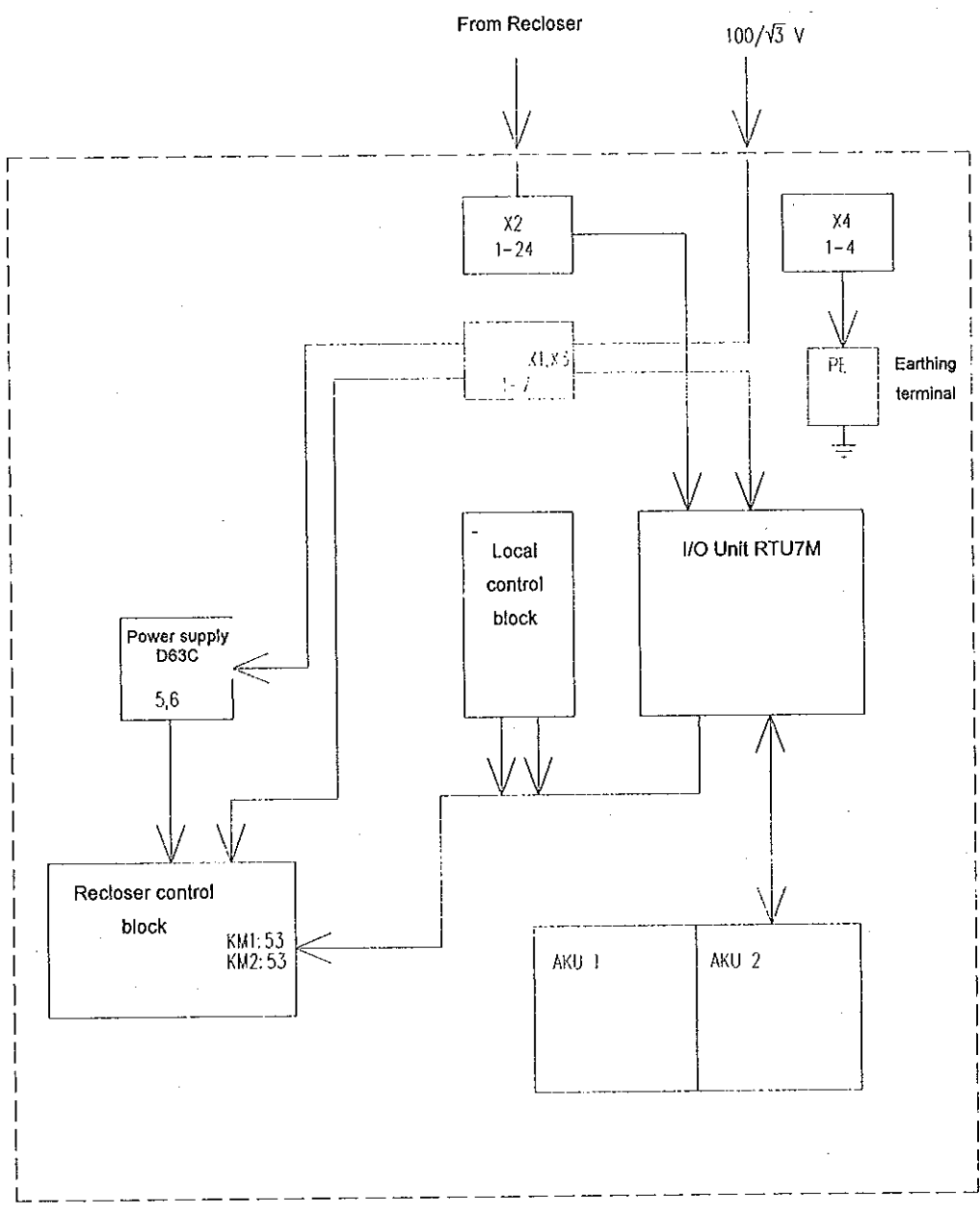
Фиг. 7 – Блок – схема на таблото за дистанционно управление

Линейна схема на свързване на таблото DO – схема 1,2

KM1, KM2 - Contactor
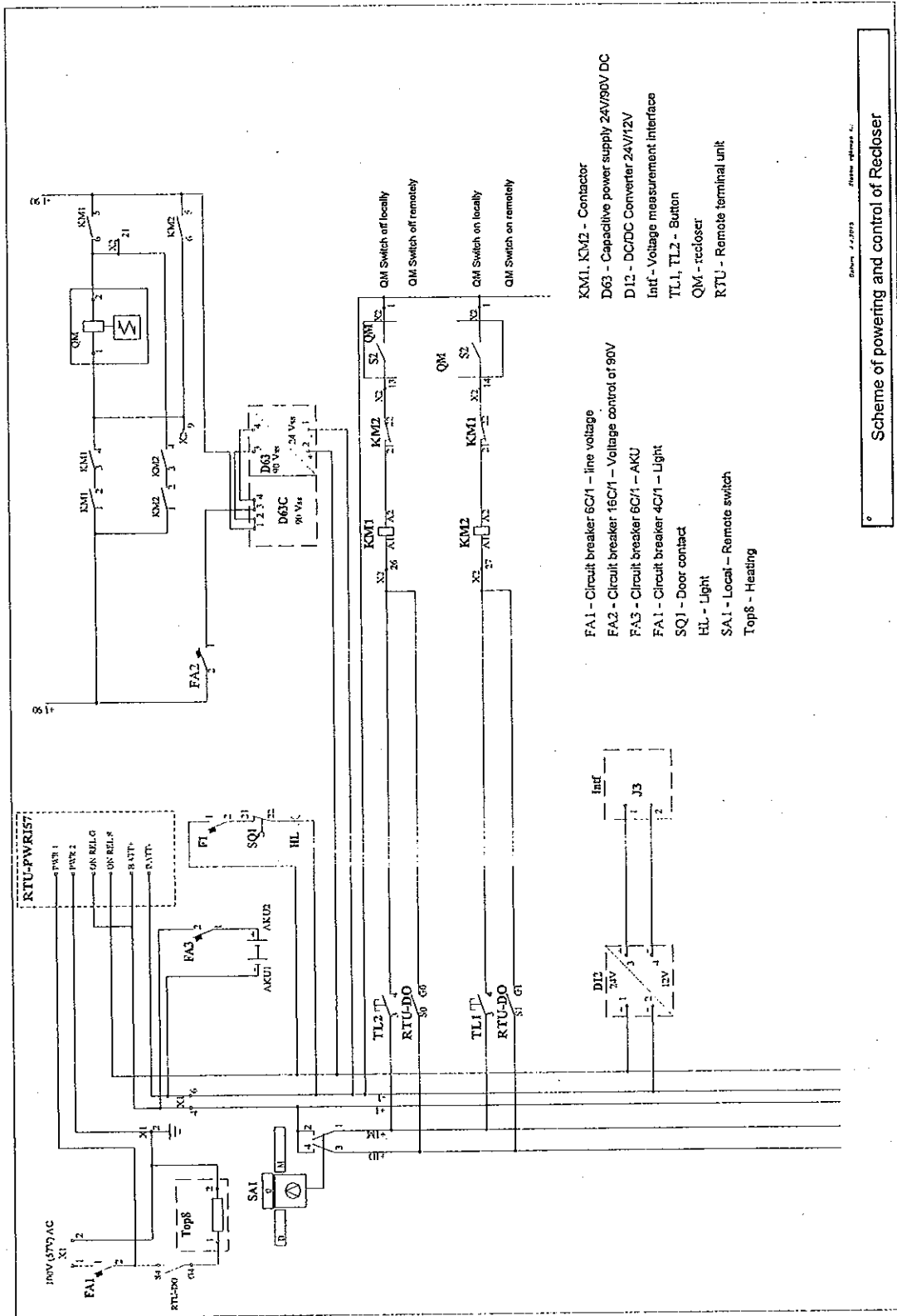D63 - Capacitive power supply 24V/90V DC
D12 - DC/DC Converter 24V/12V
Intf - Voltage measurement interface
TL1, TL2 - Button
QM - recloser
RTU - Remote terminal unit

QM Switch off locally
QM Switch off remotely
QM Switch on locally
QM Switch on remotely

FA1 - Circuit breaker 6C/1 – line voltage
FA2 - Circuit breaker 16C/1 – Voltage control of 90V
FA3 - Circuit breaker 6C/1 – AKU
FA1 - Circuit breaker 4C/1 – Light
SQ1 - Door contact
HL - Light
SA1 - Local – Remote switch
Top8 - Heating

Scheme of powering and control of Recloser

Scheme of signaling and measurement of Recloser

Signalization

RTU-DI

Terminal	Signal
A0	QM ON
A1	QM OFF
*A2	
A3	Locally
A4	Door
A5	Circuit breaker of voltage control
A6	Presence of voltage control
A7	Circuit breaker of AKU
A-	

QM 33QM X2
24 12   29
    43QM   30
    23

SA1 (D)
SQ1
FA2
D63
FA3

RTU-AI — Current measurement

X3
X2

RTU-AU — Voltage measurement

X3

Intf
J1 J2
X2

Datum: 11.2013

Scheme of signaling and measurement of Recloser

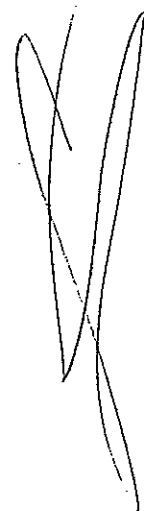# ТЕХНИЧЕСКА ИНФОРМАЦИЯ
KEMA 34 - 97

CERTIFICATE OF INTERRUPTING PERFORMANCE

PART 1

APPARATUS   A three–phase SF$_6$–insulated automatic circuit–recloser equipped with vacuum interrupters

DESIGNATION   GVR 38/6   **SERIAL No.**   Unit D

Rated voltage	38 kV	Rated frequency	50 Hz	(1)
Rated current	630 A	Rated SF$_6$–insulation pressure at 20 °C	1.0 bar(abs)	(2)

MANUFACTURER   Whipp & Bourne (1975) Ltd.,
                    Castleton, Rochdale, United Kingdom

DATE OF TESTS   15th May, 3rd and 4th June 1997

(1) This rating is not in accordance with ANSI/IEEE C37.60.
(2) The equipment is fitted with SF$_6$ gas as an insulant only.

The apparatus, constructed in accordance with the description, drawings and photographs incorporated in this Certificate, has been subjected to the series of proving tests in accordance with ANSI/IEEE C37.60 , Table 4 (See note on sheet 1).

THE RESULTS ARE SHOWN IN THE RECORD OF PROVING TESTS AND THE OSCILLOGRAMS ATTACHED HERETO. THE VALUES OBTAINED AND THE GENERAL PERFORMANCE ARE CONSIDERED TO COMPLY WITH THE ABOVE STANDARD AND TO JUSTIFY THE RATINGS ASSIGNED BY THE MANUFACTURER AS LISTED ON SHEET 1.

This Certificate and Record of Proving Tests applies only to the specific piece of apparatus tested from the particular place of manufacture. The responsibility for conformity of any apparatus having the same designation with that tested rests with the manufacturer at the place of manufacture of that apparatus.

THE DOCUMENTS FORMING PART OF THIS CERTIFICATE ARE:

Sheets	20	
Circuit diagrams	4	
Oscillograms	92	
Drawings	11	} PART 1
Photographs	2	
Information sheet	B70E	
Drawings	3	— PART 2 (numbers are listed on sheet 2 of PART 1).

KEMA Nederland B.V.

QUALIFIED
BY STERLAB

H.W. Kempen

Arnhem, 8th August 1997

KEMA

RATINGS ASSIGNED BY THE MANUFACTURER AND PROVED BY TESTS

Symmetrical interrupting current   8 kA at 38 kV

Symmetrical making current   8 kA with maximum asymmetry corresponding to $X/R = 16.5$

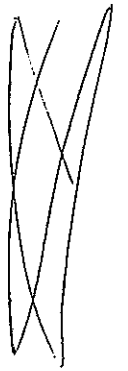Operating duty   O–0.25 s–CO–0.25 s–CO–0.25 s–C–IDMT(1)–O

(1) IDMT = Inverse delay minimum time

Note:
TRV based on IEC 56.

SUMMARY OF TESTS

	SHEET
No–load test	4
Standard operating duty 90 – 100 % (16 unit operations)	5, 6
No–load tests	7, 8
Standard operating duty 45 – 55 % (56 unit operations)	9 to 13
Standard operating duty 15 – 20 % (48 unit operations)	14 to 18
No–load test	19

Vacuum interrupters
The tested breaker was equipped with interrupters type WL 35460, manufactured by Westinghouse.

The tests were witnessed by:

Name

Collier. M.
Davenport, W.   (only 15th May 1997)
Lane, S.   (only 15th May 1997)
Poulton, D.

Company

Whipp & Bourne (1975) Ltd..
Castleton, Rochdale. United Kingdom

The tests were observed by:

Name

Barts, H.   (only 15th May 1997)
Lathouwers, A.G.A.   (only 3rd, 4th June 1997)

Company

KEMA,
Arnhem. The Netherlands

Drawings

The manufacturer has guaranteed that the equipment submitted for tests has been manufactured in accordance with the following drawings.
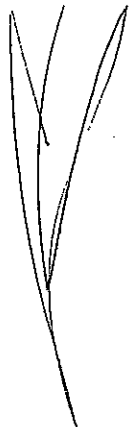KEMA has verified that these drawings adequately represent the equipment tested.

2801029–5 Rev. C
2801064–9 Rev. A
2801065–7 Rev. A
2800939–5 Rev. B
E360192 Rev. B
E252753 Rev. A
4801484–5 Rev. L
6800217–8 Rev. 2
4801495–7 Rev. E
6800161–1 Rev. 2
2800952–5 Rev. C

4801510–2 Rev. G
4801506–T Rev. C   } On request of the manufacturer these drawings are included in PART 2
6800270–2 Rev. 1

Photographs

723005
727100

REPORT 34–97		TABLE WITH TEST CIRCUITS				SHEET 3	
TEST CIRCUIT		S05	S11	S12	S13		
Number of phases		3	3	3	3		
Power frequency	Hz	50	50	50	50		
Generator neutral		not earthed	not earthed	not earthed	not earthed		
Transformer connections		$\triangle/\maltese$	$\triangle/\curlywedge$	$\triangle/\maltese$	$\triangle/\maltese$		
Short–circuit point		not earthed	earthed	not earthed	earthed		
Circuit impedance	Ω	2.54	5.26	3.54	3.54		
X/R		16.5	8	> 4	> 4		
TRV control elements added — Capacitance in parallel C_1	μF	0.2		0.088 (1)	0.088 (1)		
Resistance in series R_1	Ω	25		282	282		
Resistance in parallel R_1	Ω						
Inductance in parallel with R_1 L_1	mH						
Time delay Capacitance C_d	nF	90					
Prospective TRV — TRV peak value u_c	kV	72.0	70.0	74.0	74.0		
Time co–ordinate t_3	μs	113	46	23	23		
Time delay t_d	μs	< 16	< 7.5	< 3	< 3		
Based on	kVrms	38.0	38.0	38.0	38.0		
Depression							
Rate–of–rise	kV/μs	0.64	1.52				
Load — Reactance L_L	Ω		0.243	12.5	12.5		
Resistance R_L	Ω		0.086				
Capacitance C_2	nF			1.1	1.1		

(1) Starpoint earthed.

TABLE WITH NO—LOAD TEST RESULTS

SHEET 4

Data of mechanism: Dependent power closing (magnetic actuator).
Stored energy opening (springs, charged at closing).
Control voltage 80 Vd.c.

Rated supply voltage of closing coil .... 90 Vd.c.
Rated supply voltage of opening coil .... 80 Vd.c.

SF$_6$-insulation pressure at 20 °C 1.0 bar(abs)

Condition before tests: Recloser new.
Photograph 723005.

Date and test	Operation and time interval	Voltage closing coil V	Current closing coil A	Closing time ms	Voltage opening coil V	Current opening coil A	Opening time ms	Operating pressure bar	SF$_6$ insulation pressure at 20 °C bar (abs.)	Remarks
970515 4081	CO	90		99.9 99.9 99.9	90		25.8 26.1 26.1		1.0	

Data of travel recorder: Linear with contact travel.

Note: Where phase values are given they are to be read:
On the apparatus this corresponds with:
R R B
S   Y
T   R

KEMA

TABLE WITH TEST RESULTS

| REPORT 34-97 | TYPE OF TESTS REQUESTED: Standard operating duty 90 – 100 % | TEST CIRCUIT | 505 | SHEET | 5 |

Condition before tests:
Recloser in sane condition.
Supply to fixed contacts.
Recloser frame earthed via an earth fault current indicating CT.

Voltage closing coil 90 V
Voltage opening coil 90 V
SF₆–insulation pressure at 20 °C 1.0 bar(abs)

Operating duty: O–0.25 s–CO–0.25 s–CO–0.25 s–CO with instantaneous opening for the first three O–operations and time–delayed opening for the last O–operation.
Tests 9/0515–4090 to 4105: 16 Unit operations.

Date and test	Operation and time interval	Applied voltage between phases kV	Making current peak kA	Breaking current Phase value kA	D.c. component (< 20% if no value is given) %	Recovery voltage Phase value kV	Between phases kV	TRV [1] peak kV	Arc duration ms	Opening time ms	Break time ms	Make time ms	Remarks	Physical behaviour Flame	Gas	Oil
970515 4090	O			7.78 / 7.87 / 7.81 / 7.82		21.9 / 22.0 / 22.0 / 22.0	38.0	69.8 / – / –	5.8 / 10.1 / 10.1	25.5	35.6		Recloser cleared.	none	none	
to 4093 (3)	CO	38.9	17.9 / 21.7 / 15.3	7.93 / 8.04 / 7.94 / 7.97		21.9 / 22.2 / 22.0 / 22.0	38.2	[2] / – / –	6.2 / 11.5 / 11.5	25.4	36.9	83.0	Recloser closed and cleared.			
970515 4094	O			8.01 / 8.12 / 8.03 / 8.05		22.5 / 22.5 / 22.4 / 22.5	38.8	– / – / 71.2	10.3 / 10.3 / 5.9	25.9	36.2		Reclose cleared.	none	none	
to 4097 (3)	CO	40.9	23.1 / 15.0 / 20.0	8.32 / 8.41 / 8.34 / 8.36		23.1 / 23.1 / 22.9 / 23.0	39.9	– / – / [2]	11.2 / 11.2 / 6.0	25.9	37.1	91.8	Recloser closed and cleared.			
970515 4098	O			8.02 / 8.13 / 8.04 / 8.05		22.2 / 22.6 / 22.5 / 22.4	38.9	72.1 / – / –	3.2 / 7.1 / 7.1	25.9	33.0		Recloser cleared.	none	none	
to 4101	CO	40.7	22.4 / 19.9 / 15.0	8.29 / 8.37 / 8.29 / 8.32		22.9 / 22.9 / 22.7 / 22.8	39.5	– / – / 73.5	13.2 / 13.2 / 8.0	25.5 ˙	38.7	91.5	Recloser closed and cleared.			

Condition after tests: Recloser not inspected.

[1] Maintained for 1 s after final interruption.
(2) No TRV peak value measured due to failure of recorder.
(3) No MF–oscillogram.

Note: Where phase values are given they are to be read:
R On the apparatus this corresponds with: B Average values on the 4th line
S Y
T R

KEMA

TABLE WITH TEST RESULTS

REPORT 34—97		TYPE OF TESTS REQUESTED: Standard operating duty 90 – 100 % (continued)	TEST CIRCUIT S05	SHEET 8

Condition before tests: Recloser in same condition.

Voltage closing coil 90 V
Voltage opening coil 90 V
SF₆—insulation pressure at 20 °C 1.0 bar(abs)

Date and test	Opera- tion and time interval	Applied voltage between phases kV	Making current peak kA	Breaking current Phase values kA	D.c. com- ponent (<20% if no value is given) %	Recovery voltage Phase value kV	Between phases kV	TRV (1) peak kV	Arc duration ms	Opening time ms	Break time ms	Make time ms	Remarks
	5 min												
970515 4102	O			8.02		22.5		—	10.1				none
				8.12		22.5	38.9	—	10.1	26.1	36.2		Recloser cleared.
				8.04		22.4		71.3	5.8				
				8.05		22.5							
	Sequence												
to 4105	CO	40.6	18.6	8.27		22.7		72.2	10.2				Recloser closed and cleared.
			15.5	8.37		23.1	39.7	—	15.0	28.2	41.2	91.8	
			22.4	8.43		22.9		—	15.0				
				8.35		22.9							

Physical behaviour — Emission of: Flame | Gas | Oil

Condition after tests: Recloser not inspected.

(1) Maintained for 1 s after final interruption.

Note: Where phase values are given they are to be read: R On the apparatus this corresponds with: B Average values on the 4th time
S   R   Y
T   S   R
        T

KEMA

TABLE WITH NO-LOAD TEST RESULTS

SHEET 7

REPORT 34-97

Date of mechanism: Dependent power closing (magnetic actuator).
Stored energy opening (springs, charged at closing).
Control voltage 90 Vd.c.

Rated supply voltage of closing coil 90 Vd.c.
Rated supply voltage of opening coil 90 Vd.c.

SF_6-insulation pressure at 20 °C 1.0 bar(abs)

Condition before tests: Recloser in same condition.

Date and test	Operation and time interval	Voltage closing coil V	Current closing coil A	Closing time ms	Voltage opening coil V	Current opening coil A	Opening time ms	Operating pressure bar	SF_6 insulation pressure at 20 °C bar(abs.)	Remarks
970515 4106	CO	90		97.9 98.3 98.2	90		26.8 27.0 26.8		1.0	

Date of travel recorder: Linear with contact travel.

Note: Where phase values are given they are to be read: R   On the apparatus this corresponds with: B
S   Y
T   R
R

KEMA

REPORT 34—97 | **SHEET 8**

Date of mechanism: Dependent power closing (magnetic actuator).
Stored energy opening (springs, charged at closing).
Control voltage 90 Vd.c.

Rated supply voltage of closing coil 90 Vd.c.
Rated supply voltage of opening coil 90 Vd.c.
SF_6-insulation pressure at 20 °C 1.0 bar(abs)

Condition before tests: Recloser in same condition.

Date and test	Operation and time interval	Voltage closing coil V	Current closing coil A	Closing time ms	Voltage opening coil V	Current opening coil A	Opening time ms	Operating pressure bar	SF_6 insulation pressure at 20 °C bar(abs.)	Remarks
970603 5124	CO			98.9 98.9 98.9			28.9 28.9 28.9		1.0	

Data of travel recorder: Linear with contact travel.

Note: Where phase values are given they are to be read: R S T   On the apparatus this corresponds with: B Y R

KEMA

Voltage closing coil 00 V
Voltage opening coil 00 V
SF₆-insulation pressure at 20 °C 1.0 bar(abs)

Condition before test: Recloser in same condition.

Opening duty: O–0.25s–CO–0.25s–CO–0.25s–CO with instantaneous opening for the first three O–operations and time–delayed opening for the last O–operation.
Tests 970604–5005 5060: 58 Unit operations.

Date and test	Operation and time interval	Applied voltage between phases kV	Making current peak kA	Breaking current Phase value kA	D.c. component (< 20% if no value is given) %	Recovery voltage Phase value kV	Between phases kV	TRV (1) peak kV	Arc duration ms	Opening time ms	Break time ms	Make time ms	Flame	Gas	Oil	Remarks
970604 5005	O			4.07 4.03 4.03 4.04		22.1 21.9 21.7 21.9	37.9	– – 65.8	7.2 7.2 3.0	16.5	23.7		none			Recloser cleared.
to 5008	sequence CO	43.5	11.1 13.0 8.78	4.52 4.57 4.52 4.57		24.0 24.4 24.3 24.2	42.0	71.2 – –	4.5 9.9 9.9	16.3	26.2	93.0				Recloser closed and cleared.
970604 5009	5 min O			4.07 4.03 4.03 4.04		22.1 22.2 22.0 22.1	38.3	– – 64.5	7.4 7.4 3.3	16.5	23.9		none			Recloser cleared.
to 5012	sequence CO	38.1	10.4 7.18 11.2	4.02 4.07 4.02 4.04		22.0 22.4 22.3 22.2	38.5	– 60.5 –	10.5 5.2 10.5	16.3	28.8	95.0				Recloser closed and cleared.
970604 5013	5 min O			4.07 4.03 4.03 4.04		22.1 22.2 22.0 22.1	38.3	– 61.7 89.0	11.1 5.8 11.1	16.8	28.0		none			Recloser cleared.
to 5016	sequence CO	39.3	10.1 8.33 11.8	4.12 4.17 4.12 4.14		22.0 22.1 22.0 22.0	38.2	– 64.1 –	10.5 5.2 10.5	16.0 ¹	26.5	93.0				Recloser closed and cleared.

Condition after test: Recloser not inspected.

(1) Maintained for 1 s after final interruption.

Note: Where phase values are given they are to be read: R   On the apparatus this corresponds with: B   Average values on the 4th line
S   Y
T   R

KEMA

Voltage closing coil   90 V
Voltage opening coil   90 V
SF₆-insulation pressure at 20 °C   1.0 bar(abs)

Date and test	Operation and time interval	Applied voltage between phases (kV)	Making current peak (kA)	Breaking current Phase value (kA)	D.c. component (< 20% if no value is given) (%)	Recovery voltage Phase value (kV)	Between phases (kV)	TRV [1] peak (kV)	Arc duration (ms)	Opening time (ms)	Break time (ms)	Make time (ms)	Flame	Gas	Oil	Remarks
970604 5017	5 min O			4.07 4.03 4.03 4.04		22.1 22.2 22.0 22.1	38.3	— — 67.3	7.2 7.2 3.1	17.0	24.2		none			none. Recloser cleared.
to 5020	sequence CO	39.3	11.7 7.39 12.1	4.12 4.17 4.12 4.14		22.0 22.1 22.0 22.0	38.2	— 66.8 —	10.7 5.5 10.7	18.2	26.9	94.0				Recloser closed and cleared.
970604 5021	5 min O			4.07 4.03 4.03 4.04		22.1 22.2 22.0 22.1	38.3	— — 67.3	7.2 7.2 3.1	18.7	23.9		none			none. Recloser cleared.
to 5024	sequence CO	39.3	6.68 11.1 11.4	4.12 4.17 4.12 4.14		22.0 22.1 22.0 22.0	38.2	— 65.8 —	8.7 3.4 8.7	18.3	27.0	94.0				Recloser closed and cleared.
970604 5025	8 min O			4.14 4.11 4.11 4.12		22.3 22.1 22.0 22.1	38.3	— — 67.3	7.2 7.2 3.1	18.4	25.8		none			none. Recloser cleared.
to 5028	sequence CO	40.0	8.90 11.7 10.3	4.12 4.17 4.12 4.14		22.0 22.1 22.0 22.0	38.2	65.9 — —	6.0 11.3 11.3	18.5	26.8	95.0				Recloser closed and cleared.

Condition after tests: Recloser not inspected.

Note: Where phase values are given they are to be read: R   On the apparatus this corresponds with: R
S   Y
T   B   Average values on the 4th line

(1) Maintained for 1 s after final interruption.

KEMA

REPORT 24-97

TYPE OF TESTS REQUESTED: Standard operating duty 45 – 55 % (continued)

Condition before test: Recloser in same condition.

Voltage closing coil   90 V
Voltage opening coil   90 V
SF6 – insulation pressure at 20 °C   1.0 bar(abs)

Date and test	Operation and time interval	Applied voltage between phases kV	Making current peak kA	Breaking current Phase value kA	D.c. component (< 20% if no value is given) %	Recovery voltage Phase value kV	Recovery voltage Between phases kV	TRV (1) peak kV	Arc duration ms	Opening time ms	Break time ms	Make time ms	Remarks
													Physical behaviour — Emission of: Flame / Gas / Oil
970604 5029	4 min O			4.24 4.21 4.21 4.22		23.3 23.1 23.2 23.2	40.2	– – 71.5	7.4 7.4 3.3	16.6	24.0		none none / Recloser cleared.
to 5032	sequence CO	40.0	7.49 12.1 11.7	4.48 4.48 4.39 4.45		22.7 22.5 22.2 22.5	38.9	– 68.2 –	8.6 3.3 8.6	16.3	24.8	95.0	Recloser closed and cleared.
970604 5033	5 min O			4.24 4.21 4.21 4.22		23.3 23.1 23.2 23.2	40.2	– – 71.5	7.3 7.3 3.1	16.6	23.8		none none / Recloser cleared.
to 5036	sequence CO	40.0	8.49 10.8 12.3	4.48 4.48 4.39 4.45		22.7 22.5 22.2 22.5	38.9	– 68.5 –	9.5 4.2 9.5	16.4	25.9	94.0	Recloser closed and cleared.
970604 5037	3 min O			4.24 4.21 4.21 4.22		23.3 23.1 23.2 23.2	40.2	– – 71.8	7.5 7.5 3.4	16.5	24.0		none none / Recloser cleared.
to 5040	sequence CO	40.0	8.63 12.7 11.2	4.48 4.48 4.39 4.45		22.7 22.5 22.2 22.5	38.9	70.0 – –	5.7 11.0 11.0	16.3	25.8	95.0	Recloser closed and cleared.

Condition after tests: Recloser not inspected.

Note: Where phase values are given they are to be read: R   On the apparatus this corresponds with: B   Average values on the 4th line
   S   Y
   T   R

(1) Maintained for 1 s after final interruption.

KEMA

Condition before tests: Recloser in same condition.

Voltage closing coil 80 V
Voltage opening coil 90 V
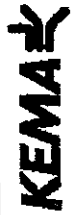SF$_6$—insulation pressure at 20 °C 1.0 bar(abs)

Date and test	Operation and time interval	Applied voltage between phases kV	Making current peak kA	Breaking current Phase value kA	Breaking current D.c. component (< 20% if no value is given) %	Recovery voltage Phase value kV	Recovery voltage Between phases kV	TRV peak kV (1)	Arc duration ms	Opening time ms	Break time ms	Make time ms	Remarks	Physical behaviour Flame	Gas	Oil
970604 5041	5 min O			4.24 / 4.21 / 4.21 / 4.22		23.3 / 23.1 / 23.2 / 23.2	40.2	– / – / 71.6	7.3 / 7.3 / 3.1	16.5	23.8		none / Recloser cleared.	none	none	none
to 5044	sequence CO	40.0	10.8 / 12.9 / 9.14	4.48 / 4.48 / 4.39 / 4.45		22.7 / 22.5 / 22.2 / 22.5	38.9	69.4 / – / –	4.5 / 9.8 / 9.8	16.5	26.3	96.0	Recloser closed and cleared.			
970604 5045	4 min O			4.24 / 4.21 / 4.21 / 4.22		23.3 / 23.1 / 23.2 / 23.2	40.2	– / 69.4 / –	8.0 / 3.7 / 8.0	16.5	24.5		none / Recloser cleared.	none	none	none
to 5048	sequence CO	40.0	12.6 / 12.2 / 7.64	4.48 / 4.48 / 4.39 / 4.45		22.7 / 22.5 / 22.2 / 22.5	38.8	69.4 / – / –	2.9 / 8.2 / 8.2	16.5	24.7	95.0	Recloser closed and cleared.			
970604 5049	5 min O			4.24 / 4.21 / 4.21 / 4.22		23.3 / 23.1 / 23.2 / 23.2	40.2	– / 69.4 / –	8.0 / 3.7 / 8.0	16.5	24.5		none / Recloser cleared.	none	none	none
to 5052	sequence CO	40.0	13.0 / 10.2 / 9.70	4.48 / 4.48 / 4.39 / 4.45		22.7 / 22.5 / 22.2 / 22.5	38.9	– / – / 72.2	10.5 / 10.5 / 5.3	16.5	27.0	95.0	Recloser closed and cleared.			

Condition after tests: Recloser not inspected.

Note: Where phase values are given they are to be read: R / S / T. On the apparatus this corresponds with: R / Y / B. Average values on the 4th line.

(1) Maintained for 1 s after final interruption.

KEMA

TYPE OF TESTS REQUESTED: Standard operating duty 45 – 55 % (continued)

Voltage closing coil   90 V
Voltage opening coil   90 V
SF6—insulation pressure at 20 °C   1.0 bar(abs)

Condition before tests: Recloser in same condition.

Date and test	Opera- tion and time Interval		Applied voltage between phases kV	Making current peak kA	Breaking current Phase value kA	D.c. com- ponent (<20% if no value is given) %	Recovery voltage Phase value kV	Between phases kV	TRV (1) peak kV	Arc duration ms	Opening time ms	Break time ms	Make time ms	Physical behaviour — Emission of: Flame / Gas / Oil	Remarks
	4 min													none	none
970504 5053		O			4.24 4.21 4.21 4.22		23.3 23.1 23.2 23.2	40.2	– 69.6 –	7.8 3.6 7.8	18.8	24.8			Recloser cleared.
	sequence		40.0	12.8 10.1 9.62	4.48 4.48 4.38 4.45		22.7 22.5 22.2 22.5	38.9	– – 72.0	10.3 10.3 5.0	16.3	28.6	96.0		Recloser closed and cleared.
to 5056	CO														
	4 min													none	none
970504 5057		O			4.24 4.21 4.21 4.22		23.3 23.1 23.2 23.2	40.2	– 69.6 –	7.8 3.6 7.8	16.5	24.3			Recloser cleared.
	sequence		40.0	12.5 7.94 13.0	4.48 4.48 4.38 4.45		22.7 22.5 22.2 22.5	38.8	– 70.9 75.5	11.5 6.33 11.5	16.3	27.8	96.0		Recloser closed and cleared.
to 5060	CO														

Condition after tests: Recloser not inspected.

(1) Maintained for 1 s after final interruption.

Note: Where phase values are given they are to be read: R On the apparatus this corresponds with: B   Average values on the 4th line
S   Y
T   R

KEMA

Condition before tests: Recloser in same condition.

Voltage closing coil: 90 V
Voltage opening coil: 90 V
SF₅—insulation pressure at 20 °C: 1.0 bar(abs)

Operating duty: O-0.25 s—CO-0.25 s—CO-0.25 s—CO with instantaneous opening for the first three O—operations and time—delayed opening for the last O—operation.
Tests 970504—5069 to 5100: 32 Unit operations with supply side earthed.

Data and test	Opera- tion and time interval	Applied voltage between phases kV	Test quantities Breaking current Making current peak kA	Breaking current Phase value kA	D.c. com- ponent (< 20% if no value is given) %	Recovery voltage Phase value kV	Between phases kV	TRV peak kV [1]	Performance data Arc duration ms	Opening time ms	Break time ms	Make time ms	Physical behaviour Emission of Flame	Gas	Oil	Remarks
970504 5069	O			1.53 1.54 1.54 1.54		21.8 21.8 21.9 21.8	37.8	— 62.8 92.8	10.5 5.2 10.5	17.3	27.8		none	none		none Recloser cleared.
to 5072	CO (sequence)	38.1	3.85 2.30 3.86	1.53 1.54 1.54 1.54		21.8 21.8 21.9 21.8	37.8	— 66.0 —	8.1 4.0 8.1	16.9	28.0	95.0				Recloser closed and cleared.
970504 5073	O (7 min)			1.58 1.59 1.59 1.59		22.4 22.3 22.4 22.4	38.7	— 75.0 85.2	8.8 4.4 8.8	18.0	27.8		none	none		none Recloser cleared.
to 5076	CO (sequence)	38.1	3.82 2.72 4.21	1.58 1.59 1.59 1.59		22.2 22.1 22.1 22.1	38.3	78.5 115 —	8.4 11.1 11.1	17.2	28.3	96.0				Recloser closed and cleared.
970504 5077	O (5 min)			1.58 1.59 1.59 1.59		22.4 22.3 22.4 22.4	38.7	— — 84.9	6.2 6.2 2.1	17.9	24.1		none	none		none Recloser cleared.
to 5080	CO (sequence)	39.1	2.73 3.63 4.13	1.58 1.59 1.59 1.59		22.2 22.1 22.1 22.1	38.3	83.0 — —	4.6 8.6 8.6	16.9	26.5	96.0				Recloser closed and cleared.

Condition after tests: Recloser not inspected.

(1) Maintained for 1 s after final interruption.

Note: Where phase values are given they are to be read: R / S / T   On the apparatus this corresponds with: R / S / T   B = Average values on the 4th line.   Y   R

KEMA

TABLE WITH TEST RESULTS

Condition before tests: Recloser in same condition.

Voltage closing coil 90 V
Voltage opening coil 90 V
SF6–insulation pressure at 20 °C   1.0 bar(abs)

Date and test	Operation and time interval	Applied voltage between phases kV	Making current peak kA	Breaking current Phase value kA	D.c. component (< 20% if no value is given) %	Recovery voltage Phase value kV	Between phases kV	TRV (1) peak kV	Arc duration ms	Opening time ms	Break time ms	Make time ms	Remarks
970604 5081	4 min O			1.58 1.59 1.59 1.58		22.4 22.3 22.4 22.4	38.7	– 80.5 83.5	6.2 6.2 2.0	17.7	23.9		Recloser cleared.
to 5084	sequence CO	39.1	3.81 2.78 4.25	1.58 1.59 1.59 1.59		22.2 22.1 22.1 22.1	38.3	82.1 – –	5.6 10.5 10.5	17.4	27.8	98.0	Recloser closed and cleared.
970604 5085	4 min O			1.58 1.59 1.59 1.59		22.4 22.3 22.4 22.4	38.7	– 74.2 –	10.2 4.8 10.2	19.8	29.8		Recloser cleared.
to 5088	sequence CO	39.1	3.60 2.91 4.22	1.58 1.59 1.59 1.59		22.2 22.1 22.1 22.1	38.3	81.5 – –	6.4 11.2 11.2	17.2	28.4	96.0	Recloser closed and cleared.
970604 5089	5 min O			1.58 1.59 1.59 1.59		22.4 22.3 22.4 22.4	38.7	– – 83.3	8.7 8.7 2.5	17.3	24.0		Recloser cleared.
to 5092	sequence CO	39.1	2.36 3.79 3.97	1.58 1.59 1.59 1.59		22.2 22.1 22.1 22.1	38.3	82.1 – –	3.4 8.5 8.5	17.3	25.8	96.0	Recloser closed and cleared.

Physical behaviour — Emission of: Flame none, Gas none, Oil none

Condition after tests: Recloser not inspected.   Recloser not inspected.

Note: Where phase values are given they are to be read:
R / S / T   On the apparatus this corresponds with: B / Y / R   Average values on the 4th line.

(1) Maintained for 1 s after final interruption.

KEMA

TABLE WITH TEST RESULTS

Condition before tests: Recloser in same condition.

Voltage closing coil 90 V
Voltage opening coil 90 V
SF_6—insulation pressure at 20 °C 1.0 bar(abs)

Date and test	Opera-tion and time interval	Applied voltage between phases kV	Making current peak kA	Breaking current Phase value kA	D.c. com-ponent (<20% if no value is given) %	Recovery voltage Phase value kV	Between phases kV	TRV (1) peak kV	Arc duration ms	Opening time ms	Break time ms	Make time ms	Remarks	Physical behaviour Emission of Flame	Gas	Oil
970604 5093	3 min / O			1.58 1.59 1.59 1.59		22.4 22.3 22.4 22.4	38.7	81.0 – –	3.1 7.8 7.8	17.5	25.3		none Recloser cleared.	none		
to 5096	sequence / CO	39.1	4.18 3.70 2.84	1.58 1.59 1.59 1.59		22.2 22.1 22.1 22.1	38.3	– – 82.4	7.7 7.7 2.5	17.1	24.8	97.0	Recloser closed and cleared.			
970604 5097	5 min / O			1.58 1.59 1.59 1.59		22.4 22.3 22.4 22.4	38.7	– 75.7 –	8.0 3.3 8.0	18.3	27.3		none Recloser cleared.	none		
to 5100	sequence / CO	39.1	3.77 4.09 2.52	1.58 1.59 1.59 1.59		22.2 22.1 22.1 22.1	38.3	– – 82.5	9.6 9.6 4.5	17.2	26.8	97.0	Recloser closed and cleared.			

Condition after tests: Recloser not inspected.

(1) Maintained for 1 s after final interruption.

Note: Where phase values are given they are to be read: R — On the apparatus this corresponds with: B Average values on the 4th line
S Y
T R

KEMA

TABLE OF TEST RESULTS (continued)

Condition before test: Recloser in same condition.

Tests 970604-5101 to 5116: 16 Unit operations with supply and load side earthed.

Voltage closing coil ... 90 V
Voltage opening coil ... 90 V
SF₆ – insulation pressure at 20 °C ... 1.0 bar (abs)

Date and test	Operation and time interval	Applied voltage between phases (kV)	Making current peak (kA)	Breaking current Phase value (kA)	D.c. component (< 20% if no value is given) (%)	Recovery voltage Phase value (kV)	Between phases (kV)	TRV peak (1) (kV)	Arc duration (ms)	Opening time (ms)	Break time (ms)	Make time (ms)	Remarks
970604 5101	O			1.58 1.59 1.59 1.59		22.4 22.3 22.4 22.4	38.7	47.3 49.3 51.3	5.8 3.1 9.8	18.0	27.8		none / none Recloser cleared.
to 5104	sequence CO	39.1	3.65 4.08 2.71	1.58 1.59 1.59 1.59		22.2 22.1 22.1 22.1	38.3	49.8 45.2 49.7	1.3 8.2 4.6	17.0	25.2	98.0	Recloser closed and cleared.
970604 5105	5 min O			1.58 1.59 1.59 1.59		22.4 22.3 22.4 22.4	38.7	47.5 48.5 51.7	6.2 3.4 10.2	17.8	27.8		none / none Recloser cleared.
to 5108	sequence CO	39.1	3.25 4.18 3.26	1.58 1.59 1.59 1.59		22.2 22.1 22.1 22.1	38.3	48.8 44.7 49.7	2.3 8.2 5.8	18.7	25.9	98.0	Recloser closed and cleared.
970604 5109	4 min O			1.58 1.59 1.58 1.59		22.4 22.3 22.4 22.4	38.7	51.2 50.7 52.1	8.4 4.7 2.2	18.1	28.5		none / none Recloser cleared.
to 5112	sequence CO	39.1	2.36 3.94 3.79	1.58 1.58 1.59 1.59		22.2 22.1 22.1 22.1	38.3	48.9 51.3 51.2	4.2 10.9 7.5	18.8	27.7	97.0	Recloser closed and cleared.

Condition after test: Recloser not inspected.

(1) Maintained for 1 s after final interruption.

Note: Where phase values are given, they are to be read: R   On the apparatus this corresponds with: B   Average values on the 4th line
S   Y
T   R

KEMA

TYPE OF TESTS REQUESTED: Standard operating duty 15 – 20 % (continued)

Condition before tests: Recloser in same condition.

Voltage closing coil   80 V
Voltage opening coil   80 V
SF$_6$—insulation pressure at 20 °C   1.0 bar(abs)

Date and test	Operation and time interval	Applied voltage between phases kV	Making current peak kA	Breaking current Phase value kA	D.c. component (< 20% if no value is given) %	Recovery voltage Phase value kV	Recovery voltage Between phases kV	TRV (1) peak kV	Arc duration ms	Opening time ms	Break time ms	Make time ms	Physical behaviour — Emission of Flame	Gas	Oil	Remarks
	5 run												none			none
970604 5113	O			1.58 1.59 1.59 1.59		22.4 22.3 22.4 22.4	38.7	51.5 50.2 50.7	9.2 5.5 2.9	17.2	26.4					Recloser cleared.
	sequence															
to 5116	CO	39.1	2.84 4.12 3.61	1.58 1.59 1.59 1.59		22.2 22.1 22.1 22.1	38.3	49.3 51.8 52.0	2.8 9.6 6.1	16.8	26.4	89.0				Recloser closed and cleared.

Condition after tests: Recloser not inspected.

(1) Maintained for 1 s after final interruption.

Note: Where phase values are given they are to be read: R   On the apparatus this corresponds with: R   B   Average values on the 4th line.
    S   Y
    T   R

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TABLE WITH NO-LOAD TEST RESULTS

Date of mechanism: Dependent power closing (magnetic actuator).
Stored energy opening (springs, charged at closing).
Control voltage 90 V.d.c.

Rated supply voltage of closing coil   90   V.d.c.
Rated supply voltage of opening coil   90   V.d.c.

SF$_6$-insulation pressure at 20 °C   1.0 bar(abs)

Condition before tests: Recloser in same condition.

Date and test	Operation and time interval	Voltage closing coil	Current closing coil	Closing time	Voltage opening coil	Current opening coil	Opening time	Operating pressure	SF$_6$ insulation pressure at 20 °C	Remarks
		V	A	ms	V	A	ms	bar	bar(abs.)	
970604 5121	CO			103 103 103			27.9 27.9 27.9		1.0	

Data of travel recorder: Linear with contact travel.

Condition after tests: Externally no visible change. Photograph 727100.
For assessment of the condition of the vacuum interrupters see sheet 20.

Recloser complies with ANSI/IEEE C37.60, Section 6.3.4.3.

Note: Where phase values are given they are to be read: R   On the apparatus this corresponds with: B
     S   Y
     T   R

KEMA

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ASSESSMENT OF THE CONDITION AFTER TESTS OF VACUUM INTERRUPTERS

Dielectric test (state of vacuum)

Recloser withstood a power–frequency voltage across open vacuum interrupters before and after the short–circuit tests.
Before short–circuit tests: (70 kV – 50 Hz – 1 min)
After short–circuit tests: (60 kV – 50 Hz – 1 min)

Measurement of contact resistance

POLE	INTERRUPTER SERIAL No.	Contact resistance (measured with 100 A d.c.)	
		AVERAGE BEFORE TEST 970515–4081 μΩ	AVERAGE AFTER TEST 970604–5121 μΩ
R	9610G 98338	177.8	206.7
Y	9610G 98276	193.6	330.9
R	9610G 98261	188.8	192.0

The results of the contact resistance measurements indicate that the interrupters are capable of carrying the rated normal current without exceeding the prescribed temperature–rise limits.

TEST CIRCUIT DIAGRAM

CIRCUIT COMPONENTS

G = Generator
MB = Master Breaker
MS = Make Switch
PT = Power Transformer

R = Resistor
C = Capacitor
L = Inductance

TO = Test Object
AL = Artificial Line

MEASUREMENTS

U = Voltage Measurement
I = Current Measurement

Suffix of U and I
L = Low-frequency Oscillograph
H = High-frequency Oscillograph

LD = Differential measurement with L
HD = Differential measurement with H

G MB MS L PT U_{LHD} I_L R_1C_1 C_d TO

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CIRCUIT COMPONENTS

G = Generator
MB = Master Breaker
MS = Make Switch
PT = Power Transformer

R = Resistor
C = Capacitor
L = Inductance

TO = Test Object
AL = Artificial Line

MEASUREMENTS

U = Voltage Measurement
I = Current Measurement

Suffix of U and I

L = Low–frequency Oscillograph
H = High–frequency Oscillograph

LD = Differential measurement with L
HD = Differential measurement with H

G   MB MS L   PT U_{LHD} I_L TO U_{LHD} R_L L_L

KEMA

CIRCUIT COMPONENTS

G = Generator
MB = Master Breaker
MS = Make Switch
PT = Power Transformer

R = Resistor
C = Capacitor
L = Inductance

TO = Test Object
AL = Artificial Line

MEASUREMENTS

U = Voltage Measurement
t = Current Measurement

Suffix of U and I
L = Low—frequency Oscillograph
H = High—frequency Oscillograph

LD = Differential measurement with L
HD = Differential measurement with H

TEST CIRCUIT No.   813

KEMA

Circuit labels: G   MB   MS   L   PT R_1C_1 U_{LHD} I_L TO U_{LHD} C_2 L_L

Chassis dimensions (mm)

Dimensions of chassis with 2 slots
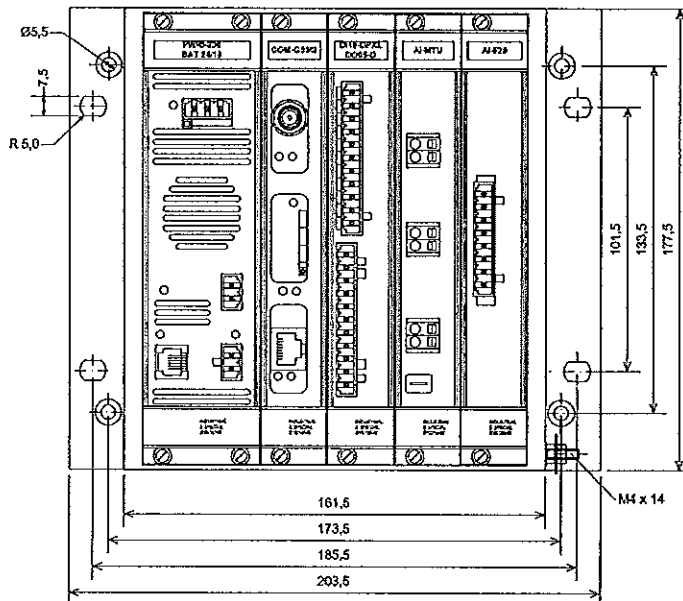
Dimensions of chassis with 5 slots
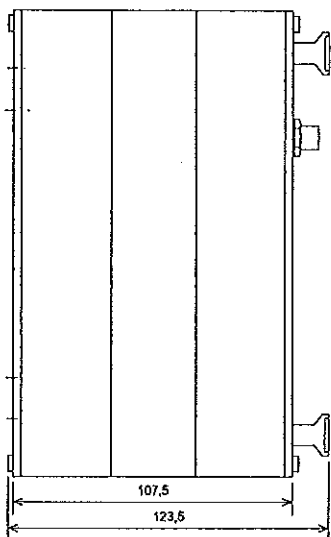
Side dimensions of all types of chassis
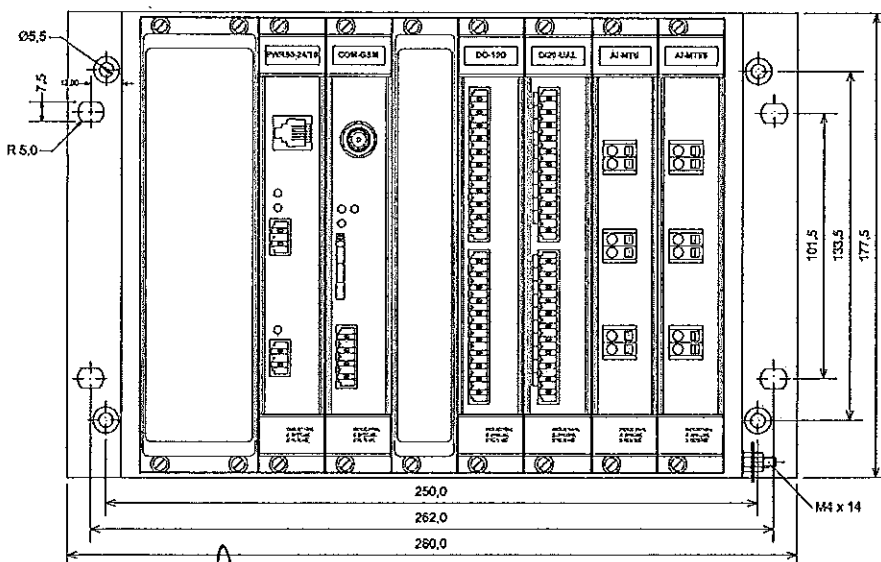
Dimensions of chassis with 8 slots

ELVAC a.s.   Hasičská 53, 700 30 Ostrava - Hrabůvka, Czech Republic
Tel.: +420 597 407 323, Fax: +420 597 407 102, www.rtu.cz

23
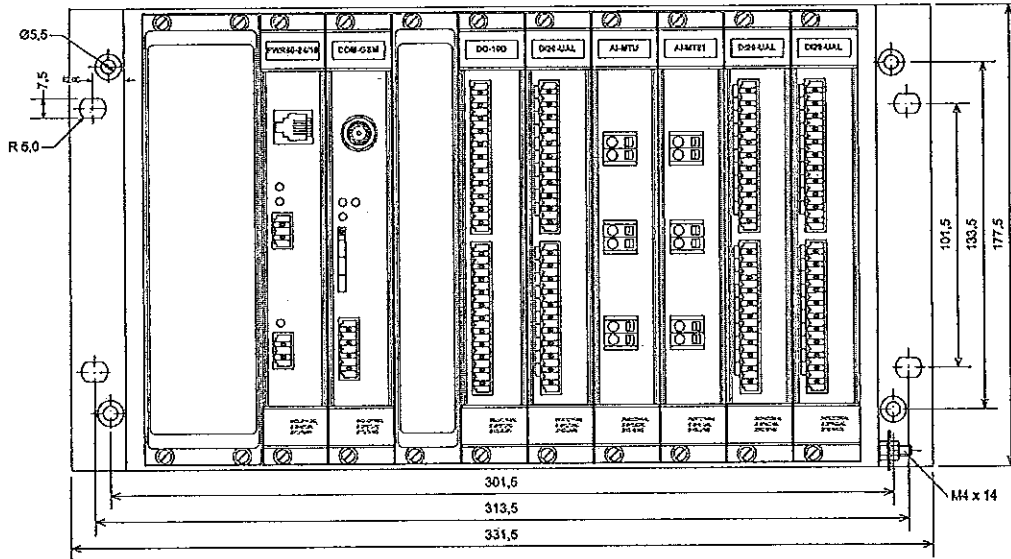
Dimensions of chassis with 10 slots
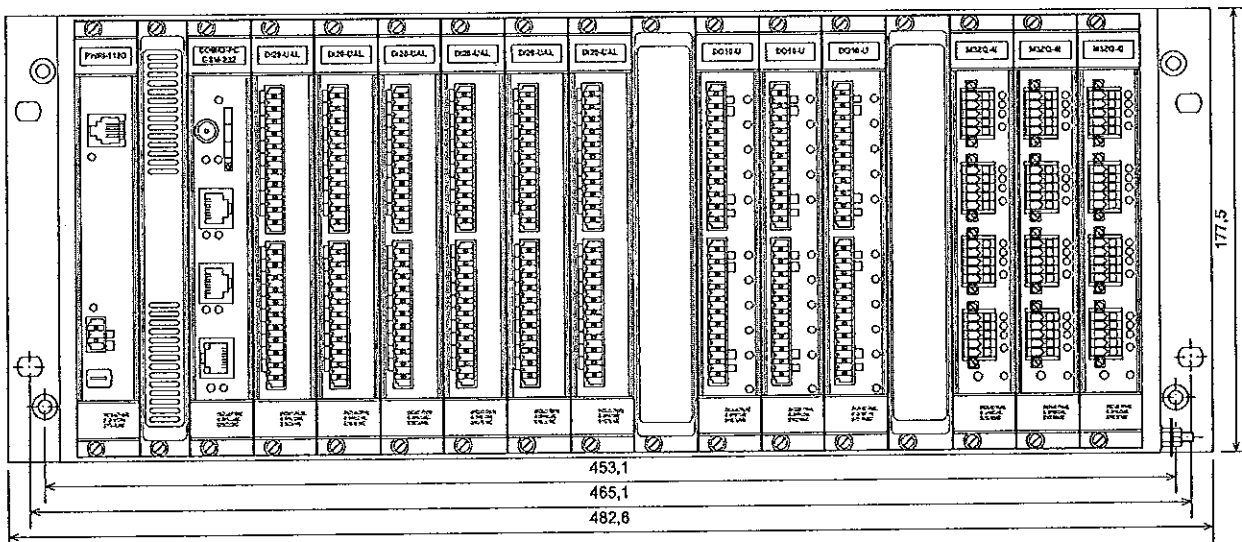
Dimensions of chassis with 16 slots

RTU7M – power supply cards

General description

Power supply cards serve for the powering of RTU7, all cards and slave units in bus. We deliver three principally different types:

☑ DC, not isolated, card with backup,
☑ DC, galvanically isolated card,
☑ AC / DC, galvanically isolated card with backup.

DC, not isolated, card with backup

This power supply card has an input range of 12-60 V DC and is mostly used with a power supply adapter. The width of card is only 25 mm and enables to connect a backup battery. The switching of the backup battery is automatic after an outage of the input power supply voltage. Both inputs, primary, as well as battery input, are protected by fuses and are equipped with over-voltage protection. During operation from the backup battery, the battery status is checked for protection against the full discharging. In the case of a decrease of the battery voltage below the minimum value, the unit enters into the shutdown regime for one minute. Information about this status, as well as the information about the outage of the input voltage is transferred into the master system. After one minute, if there is no restoration of the supply of input voltage, the unit is automatically switched off. The power supply card includes the integrated charger for 12 V or 24 V backup batteries with various capacities. The maximum maintenance charging current is 1.1 A. The charging of the battery is controlled by the unit processor depending on the temperature. The capacity of the battery is periodically tested and the value is transferred to the master system. In the case of use of backup battery, the input voltage must be minimally higher by 5 V than the nominal voltage of the battery. Connector RJ-12 is on the card, to which it is possible to connect external signalization and external temperature sensor. This sensor is typically used for measuring the temperature close to the battery or the surrounding temperature of the unit (temperature in the switchboard cabinet). The range of the measured temperature is -55 °C to 125 °C, with the accuracy ±0.5 °C in the range -10 °C to 85 °C. On each card are three signaling LED. The first diode indicates the presence of the primary voltage, the second indicates the status of the communication unit, and the third indicates the status of the battery and the charger.

DC, galvanically isolated card

This card differs from the previous one by the fact that it has a galvanically separated input from the output, has a wide range of power supply voltage (according to the version of the card) and does not enable to connect the backup battery. The width of card is 45 mm and it is mostly used for the powering from the battery with various voltage levels according to the specification. There are two connectors on the front panel - the connector RJ-12 with the same usage as previous card and PWR for the connection of supply voltage. After agreement with the manufacturer, the card can be produced with isolated auxiliary output 5 V or 12 V / 5 W.
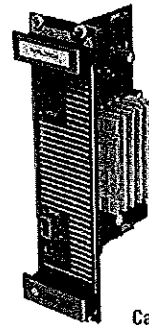
Card PWRI-220DH

AC / DC, galvanically isolated card with backup

The width of card is 45 mm and it is produced in three input ranges, see the table below. It can be used for powering from network 230 V AC / 50 Hz, but also from DC. The battery charger has identical parameters to the first version, the battery tester loads the accumulator with a current about 9 A for a 24 V battery and about 4.5 A for a 12 V battery. The card is equipped with an auxiliary contact - connector ON REL. This contact can be used to disconnect the backup battery from the unit and other devices in the switchboard cabinet, when the RTU is switched off after the power outage and after the discharging of the backup battery. Compared with previous cards, there is the switch on button BAT ON. This button activates the unit during the operation only from the backup battery. The card also enables to measure the effective value of the primary power supply voltage within the whole supply range.

Card PWR60-12/10

Card PWRI-230 BAT24/10

ELVAC a.s. Hasičská 53, 700 30 Ostrava - Hrabůvka, Czech Republic
Tel.: +420 597 407 323, Fax: +420 597 407 102, www.rtu.cz

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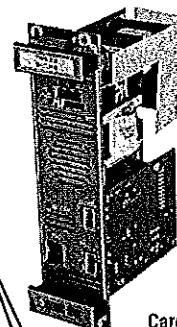
Technical specification of power supply cards with backup

Card	PWR60-24/10	PWR60-12/10	PWRI-57 BAT24/10	PWRI-57 BAT12/10	PWRI-230 BAT24/10	PWRI-230 BAT12/10	PWRI-230H BAT24/10	PWRI-230H BAT12/10
Input voltage	12–60 V DC (max. 70 W)		50–140 V AC / 47–63 Hz 70–200 V DC		90–260 V AC / 47–63 Hz 130–360 V DC		150–260 V AC / 47–63 Hz 212–360 V DC	
Range in User Center (SV)	0–65 V		0–200 V		0–360 V		0–360 V	
Max. input current	2.5 A DC		1.5 A AC; 1.2 A DC		1 A AC; 0.8 A DC		0.7 A AC; 0.5 A DC	
Input protection	3.2 A polyswitch		Fuse T 4 A					
External protection	–		Recommended circuit breaker 4 A or 6 A char. C. In case of connection to network system II, it is necessary two-pole protection.					
Output voltage	+5 V DC/4 A (20 W), -5 V DC / 1.5 A (7.5 W) / (0.3 A (1.5 W))[1]		+5 V DC / 3 A (15 W), -5 V DC / 0.3 A (1.5 W)				+5 V DC / 5 A (25 W), -5 V DC / 0.3 A (1.5 W)	
Isolation			Primary – secondary 3 kV AC for 1 minute Primary – ground 1.5 kV AC for 1 minute Secondary – ground 500 V AC for 1 minute					
Battery voltage	24 V	12 V	24 V	12 V	24 V	12 V	24 V	12 V
Range in User Center (BV)	0–30 V	0–15 V	0–30 V	0–15 V	0–30 V	0–15 V	0–30 V	0–15 V
Max. battery loading current	1 A (optionally lower current after consulting with producer)							
Max. battery maintenance voltage	27.4 V	13.7 V	27.4 V	13.7 V	27.4 V	13.7 V	27.4 V	13.7 V
Battery protection	3.2 A polyswitch							
Switch off voltage (battery protection)	22 V	11 V	22 V	11 V	22 V	11 V	22 V	11 V
Battery tester	Yes							
Testing current	1 A / 9 A[2]	1 A / 4.5 A[2]	9 A	4.5 A	9 A	4.5 A	9 A	4.5 A
Auxiliary contact ON REL	No		Contact (type NO) 250 V / 3 A AC, 30 V / 3 A DC					
BAT ON (switch on button)	No		Yes, usage for switch on of unit running from battery					
Measurement accuracy	±0.5 %, measuring of voltage on input and battery							
Temperature sensor	Measured range -55 to +125 °C, accuracy ±0.5 °C in range -10 to +85 °C							
Connectors	2 × WAGO 231-302/026-000 (part of delivery), RJ-12		2 × WAGO 231-302/026-000, 1 × WAGO 231-303/026-000 (part of delivery), RJ-12					
Wire cross-section	0,08–2.5 mm²							
Signaling LED	PWR, STAT, BAT							
Dimensions (with mounted front panel)	25 × 172 × 92 mm (W × H × D)		45 × 172 × 92 mm (W × H × D)					
Operating temperature	-20 až +55 °C							
Storage temperature	-30 až +75 °C							
Ambient relative humidity	30–95 % non-condensing							
Ingress protection	IP20							
Position in 5 / 8–10 / 16 slots bus	1 / 1.2 / 1		1 / 1 / 1					

[1] Older versions supplied max. current on -5 V line 1.5 A, from Y2011 they supply the current 0.3 A
[2] Older versions had tester 1 A, from Y2011 they are available new versions with higher testing current

Technical specification of power supply cards without backup

Card	PWRI-12D	PWRI-24D	PWRI-24DH	PWRI-48D	PWRI-110D	PWRI-220D	PWRI-220DH
Input voltage	9–18 V DC (max. 20 W)	19–36 V DC (max. 20 W)	19–36 V DC (max. 40 W)	36–75 V DC (max. 40 W)	70–150 V DC (max. 40 W)	180–370 V DC (max. 40 W)	180–370 V DC (max. 50 W)
Range in User Center (SV)	0–10 V						
Max. input current	2.6 A DC	1.2 A DC	3 A DC	1.6 A DC	0.9 A DC	0.4 A DC	0.5 A DC
Input protection	Fuse 5 × 20 F 8 A	Fuse 5 × 20 F 8 A	Fuse 5 × 20 F 8 A	Fuse 5 × 20 F 8 A	Fuse 5 × 20 F 5 A	Fuse 5 × 20 F 3.15 A	Fuse 5 × 20 F 3.15 A
External protection	In case of connection to network system IT, it is necessary two-pole protection.						
Output voltage	+5 V DC / 3 A (15 W), -5 V DC / 0.3 A (1.5 W)		+5 V DC / 6 A (30 W), -5 V DC / 0.3 A (1.5 W)				+5 V DC / 8 A (40 W), -5 V DC / 0.3 A (1.5 W)
Isolation	Input-output 1.5 kV DC		Input-output 3 kV AC, input-faston 1.5 kV AC, output-faston 500 V AC (the center of the noise filter and the converter cooler are connecter to the faston)				
Measurement accuracy	±0.5 % for output voltage						
Battery voltage	Backup battery is not supported						
AUX	It is possible to add the galvanically isolated output 5/12 V (5 W) with isolation 1.5 kV DC on customer demand						
Temperature sensor	Measured range -55 to +125 °C, accuracy ±0.5 °C in range -10 to +85 °C						
Connectors	2 × WAGO 231-302/026-000 (part of delivery), FASTON, RJ-12						
Wire cross-section	0.08–2.5 mm²						
Signaling LED	STAT, PWR						
Dimensions (with mounted front panel)	45 × 172 × 92 mm (W × H × D)						
Operating temperature	-20 to +55 °C						
Storage temperature	-30 to +75 °C						
Ambient relative humidity	30–95 % non-condensing						
Ingress protection	IP20						
Position in 5 / 8–10 / 16 slots bus	1 / 1, 2 / 1						

Front panels with connectors for individual types
of power supply cards

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Tel.: +420 597 407 323, Fax: +420 597 407 102, www.rtu.cz

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RTU7M – power backup cards

General description

Power backup card enables to use a batteries for RTU7M backup. Card switches automatically between external power supply and connected battery, if the power is lost. It also charges the battery and checks the status.

Power backup card RTU7M CHG

Power backup cards are designed for DC. They do not have the function of power supply for the RTU, they only provide stable voltage on output, if the power is lost. There must be installed the appropriate power supply card in the RTU. The output from power backup card is connected to the input of power supply card.

One power backup card can provide the backup for the RTU, where it is fitted in and also for another RTUs (there can be max. 4 RTUs connected). So it is not necessary to have the power backup card in all RTUs in system, there is only necessary to use the batteries and external power supply with sufficient performance.

Card works as a battery charger with the charging current 2 A and the extenal power supply voltage needs not be higher than the nominal battery voltage. The charging process is controled in accordance with ambient temperature and the status of battery is regularly checked.
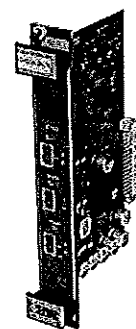
Card RTU7M
CHG24-24/30
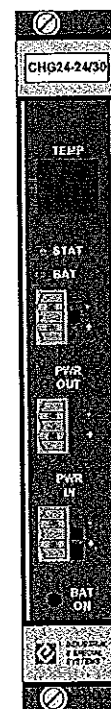
Front panel of
card RTU7M CHG

Technical specification

Card	RTU7M CHG24-24/30
Input voltage	20–30 V DC (max. 200 W)
Range in User Center (Source voltage)	0–30 V
Max. input current	10 A DC
Input protection	Fuse 5 × 20 F 16 A
External protection	In case of connection to network system IT, it is necessary two-pole protection.
Output voltage	In accordance with input voltage 20-30 V DC / 8 A (200 W)
Battery voltage	24 V
Range in User Center (Battery voltage)	0–30 V
Max. battery loading current	3.0 A (can be set in parameterization SW)
Max. battery maintenance voltage	27.4 V
Switch off voltage (battery protection)	22 V
Battery tester	Yes
Testing current	9 A
Temperature sensor	Measured range -55 to +125 °C, accuracy ±0.5 °C in range -10 to +85 °C
Connectors	2 × WAGO 231-302/026-000 (part of delivery), RJ-12
Wire cross-section	0.08–2.5 mm²
Signaling LED	STAT, PWR IN, PWR OUT, BAT
Measurement accuracy	±0.5 % for input and battery voltage
Dimensions (with mounted front panel)	25 × 172 × 92 mm (W × H × D)
Operating temperature	-20 to +55 °C
Storage temperature	-30 to +75 °C
Ambient relative humidity	30–95 % non-condensing
Ingress protection	IP20
Position in 5 / 8–10 / 16 slots bus	Any position

RTU7M – communication cards and modules

General description

The communication cards serve for ensuring the communication of the RTU7M with the master system and for communication with slave units. These cards contain four communication interfaces and have the direct support of many industrial protocols (according to the type of card and interfaces used, they are IEC 60870-5-101, IEC 60870-5-103, IEC 60870-5-104, IEC 61850, DNP3, Modbus, HioCom2). The cards also support various company protocols (e.g. protocol for communication with wireless sensors of current Z7D).

We produce two principally different versions of the cards. The first version labeled as COMIO4 contains a 32-bit processor and the second version labeled as COMIO-PC2 contains a built-in PC with operating system on the basis of OS LINUX.

Both types of communication cards have some interfaces defined as fixed and some as optional. Optional interfaces can be fitted with modules CIOMOD and configured according to the demands of the stated application. It is necessary to separately specify these modules in orders. You can see the available options in the table below. Communication parameters are set in the web interface.

Communication card COMIO4

This card is fitted with four communication interfaces which provide the user with freedom during the selection of a suitable communication protocol and the interface. The card can also be used as a communication converter or a data concentrator for slave units.

Communication card COMIO-PC2

This card is also fitted with four communication interfaces, compared with the COMIO4 card, and due to its higher intelligence, offers greater options. For example, it includes the ability to manage a larger number of slave units, the use of special protocols for secured communication or in the case of special requirements, this card can be used for client modification for communication options, such as the implementation of the another standard and special protocols, etc.

Cards COMIO4 and COMIO-PC2

In addition to the basic communication functions, it is also possible to use this card as a communication converter and as a communication concentrator. Communication protocols for communication with slave devices may differ from the communication protocol for communication with master systems. Both functions of the converter and the concentrator can be implemented at the same time.
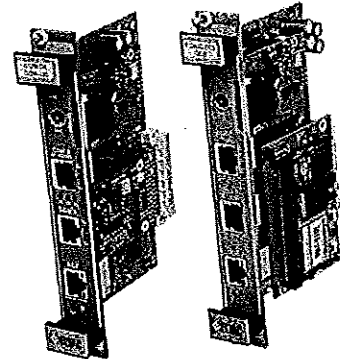
Table of standard combinations for individual interfaces of cards COMIO4 and COMIO-PC2

Card	COMIO4-1ETH	COMIO4-2ETH	COMIO4-CIR	COMIO4-O	COMIO-PC2
Communication interface COM1	Position for module CIOMOD-232/485/ GSM3/GSM4	Position for module CIOMOD-232/485/ GSM3/GSM4/GPS2	Position for module CIOMOD-OPT	Position for module CIOMOD-OPT	Position for module CIOMOD-232/485/ GSM3/GSM4
Communication interface COM2	Switchable RS-232/RS-485			Fixed optical interface OPT	Switchable RS-232/ RS-485
Communication interface COM3	Position for module CIOMOD-232/485	Ethernet 10/100 Mbps	Position for module CIOMOD-OPT	Position for module CIOMOD-OPT	Switchable RS-232/ RS-485 with powering +5 V / 0.3 A
Communication interface COM4	Ethernet 10/100 Mbps				
Memory	FLASH 64 Mbit, MRAM 256 kbit, optionally MicroSD card				FLASH 256 MB, SDRAM 128 MB, optionally MicroSD
Consumption	1.5 W				3 W
Operating temperature	-25 to +70 °C				20 to +55 °C
Storage temperature	-30 to +75 °C				
Ambient relative humidity	30–95 % non-condensing				
Ingress protection	IP20				
Position in 5 / 8 - 10 / 16 slots bus	Recommended 2 / 3 / 2				

Note: other combinations can be supplied according to the demands of customer after consultation with product manager.

Communication modules CIOMOD

These modules can fill the free positions of the communication cards with the required interfaces. The list of available interfaces is in the table.
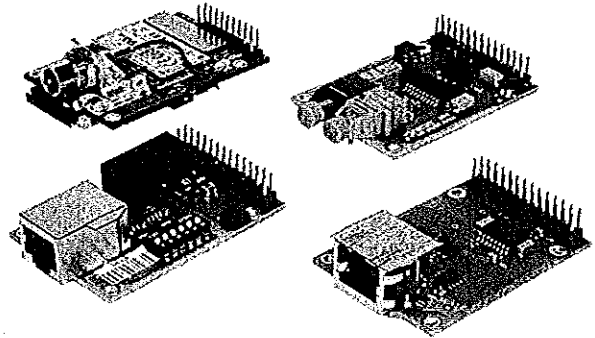
Examples of communication modules

Parameters of modules CIOMOD

Module	CIOMOD-GSM3	CIOMOD-GSM4
Communication interface	GSM Quad-band GPRS Class 12 EDGE Class 12	UMTS Dual-Band GSM Dual-band GPRS Class 12 EDGE Class 12 HSDPA Cat. 8 HSUPA Cat. 6
Antenna connector	FME	FME
Supported protocols	TCP, UDP, HTTP, FTP, SMTP, POP3	TCP, UDP, HTTP, FTP, SMTP, POP3
Max. communication speed	236.8 kbps	921.6 kbps
Signals	RxD, TxD, RTS, CTS	RxD, TxD, RTS, CTS
Max. consumption	3.2 W	4 W
Operating temperature	-40 °C to +85 °C	-40 °C to +90 °C
Storage temperature	-40 °C to +85 °C	-40 °C to +90 °C
Ambient relative humidity	30–95 % non-condensing	

Module	CIOMOD-NET	CIOMOD-OPT	CIOMOD-232	CIOMOD-485	CIOMOD-CLO	CIOMOD-GPS2
Communication interface	Ethernet 10/100 Mbps	Optical interface	RS-232 (isolation 2 kV AC for 1 min.)	RS-485 (isolation 2 kV AC for 1 min.)	Current loop (isolation 2 kV AC for 1 min.)	GPS antenna
Connector	RJ45	SC	RJ45	RJ45	RJ45	SMA
Supported protocols	UDP, IP, TCP, DHCP, Telnet, SNMP, HTTP, SMTP, ARP, SNTP, ICPMP	–	–	–	–	GPS/QZSS, GLONASS
Max. communication speed	230.4 kbps	10 Mbps	230.4 kbps (460.8 kbps)	230.4 kbps (921.6 kbps)	–	–
Signals	RxD, TxD, RTS, CTS, DTR, SR, DCD	RxD, TxD	RxD, TxD, RTS, CTS	A, B, (+5 V)	RxD, TxD	RxD, TxD, CTS (synchronization)
Max. consumption	1.7 W	1 W	1 W	1 W (2 W)	1 W	0.5 W
Operating temperature	0 °C to +60 °C	20 °C to +55 °C				-40 °C to +85 °C
Storage temperature	-30 °C to +75 °C					-40 °C to +85 °C
Ambient relative humidity	30–95 % non-condensing					
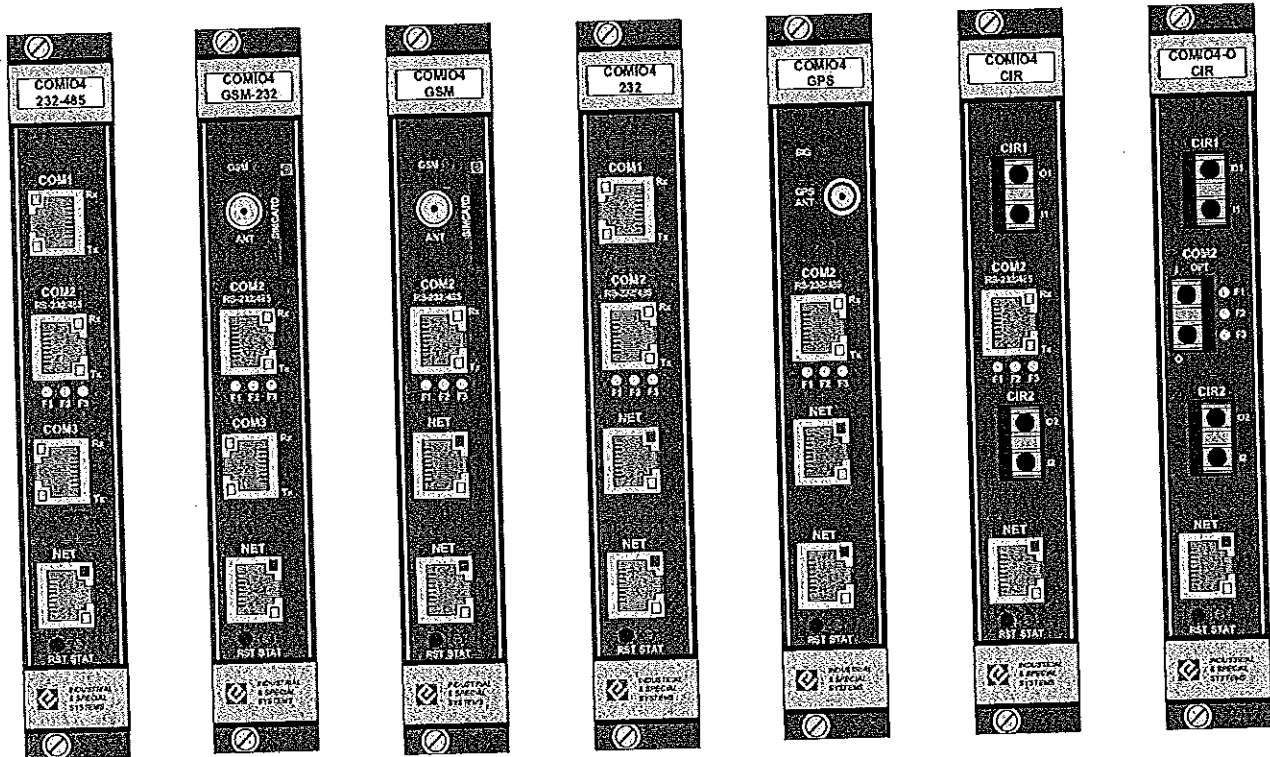
Front panels with connectors of cards COMIO4
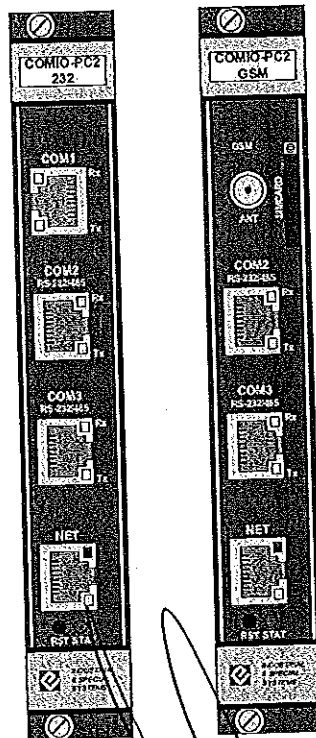
Front panels with connectors of cards COMIO-PC2

RTU7M – card with ethernet switch

General description

In cases where it is necessary to expand the number of communication links with an Ethernet interface, the RTU7M SWITCH-5ETH card is available. Basically, it is the traditional Ethernet switch in the form of the card for RTU7M, which means that internally, this card does not communicate with the RTU unit, it only takes the power from it. All connections are done externally using connecting cables. The advantage is that it is not necessary to resolve the power supply and backup as in the case of external switches, and it will save the space. The number of cards installed into the system is limited only by the space in the chassis.
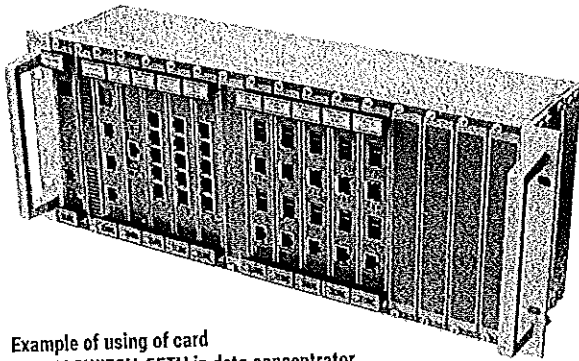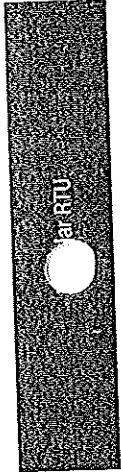
Example of using of card
RTU7M SWITCH-5ETH in data concentrator

Front panel of card RTU7M SWITCH-5ETH

Technical specification

Card	RTU7M SWITCH-5ETH
Interface	5 × RJ-45, 10/100BaseT(X) auto negotiation speed, Full/Half duplex mode, auto MDI/MDI-X connection
Standards	IEE 802.3, 802.3u, 802.3x
Consumption	Max. 3 W
Operating temperature	-10 to +60 °C
Storage temperature	-40 to +85 °C
Ambient relative humidity	30–95 % non-condensing
Ingress protection	IP20
Position in 5 / 8 –10 / 16 slots bus	Any position

RTU7M – digital inputs

General description

Digital input cards for RTU7M are produced in several basic variants:

☑ direct DI, active,
☑ direct DI, passive,
☑ indirect DI, active,
☑ indirect DI, passive.
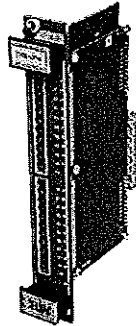
Digital input card

Direct DI

This card has inputs directly connected to the CPU of the RTU7M. The processor then evaluates and filters the input signals, etc. This card can be fitted only one in RTU7M chassis in the defined slot position (according to FW, see the user manual). The advantage is the support of automation functions such as conditioned control (relay switching on the basis of the status of the inputs on the direct DI card).

Indirect DI

The indirect digital input card has its own processor which processes the input signals (without the participation of the main processor of the RTU7M). The card behaves as a slave unit for the RTU7 series and data is transferred on an internal bus of the RTU7M unit, which serves as the communication bridge. The modules support communication protocols IEC 60870-5-101, IEC 60870-5-104 and HIOCom2. All the above-mentioned functions are supported with the exception of the automation functions. The advantage is the option to fit the cards into any position in the chassis up to the maximum number of free positions in the chassis.

Active DI

Card is equipped with its own galvanically isolated voltage source. Input is excited after connection of input pin with external shared pin via external contact.
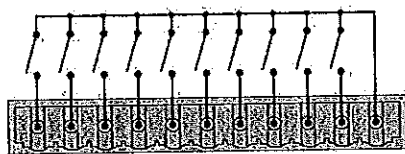
A0 A1 A2 A3 A4 A5 A6 A7 A8 A9 I-A
Active inputs connection

Passive DI

These inputs do not have the voltage source fitted. They are activated after connection of external voltage.
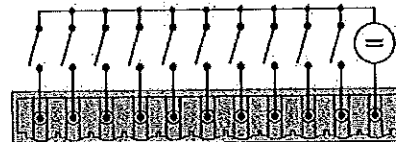
A0 A1 A2 A3 A4 A5 A6 A7 A8 A9 I-A
Passive inputs connection

Basic features

☑ 20 (10) × digital input,
☑ isolation 3.75 kV AC,
☑ indication of excitation of input,
☑ time filter can be set up by SW for both logical levels,
☑ optional double-bit signaling (ex. defining of interposition of power element),
☑ configurable maximal allowed number of changes on input per time interval,
☑ input sampling with period 1 ms,
☑ impulse counter and period measuring with data storage into memory with backup

Processing of input digital signals

Digital inputs are sampled with the period of 1 ms. The following step is filtration of the signal changes. The time filter can be set for both logical levels. If the change on the digital input lasts the stated time, the stated logical level is declared valid and sent to the master system, if required. With each change, it is monitored the exceeding of the maximal set number of changes per minute. If the maximal number of changes is exceeded, the value is transferred with a telemetric error. This prevents the useless transfer of oscillating values.

These cards can be used as simple digital inputs with one or double-bit signaling and can also be used for reading of impulses and measuring of the period with the storage of the status into the memory with backup. This can be used in applications for measuring of energy and media consumption (the function depends on the firmware used).

DI20-UPXL

Front panel of DI card

Technical specification of direct DI cards

Card	DI20-DAS	DI20-DAM	DI20-DAL	DI20-DPS	DI20-DPM	DI20-DPL	DI20-DPX	DI20-DPXL
Inputs number	20							
Inputs type	Active (switching by dry contact)			Passive (switching by external voltage, both polarities)				
Status transfer	Direct connection into main CPU							
Level H	Closed	Closed	Closed	9–25 V	20–60 V	35–60 V	75–150 V	150–300 V
Level L	Open	Open	Open	0–4 V	0–10 V	0–17 V	0–20 V	0–60 V
Current in inputs	3.6 mA	2.4 mA	2.4 mA	2.5–7 mA	1.9–6 mA	1.7–3 mA	1.3–2.7 mA	1–2 mA
SW filter for level H and L	0–16777.215 seconds, step 1 ms							
Allowed number of changes per minute	0–255							
Isolation voltage	3.75 kV AC for 1 minute							
Consumption	Max. 3 W			0.2 W				
Connectors	2 × WAGO 231-311/026-000, part of delivery							
Wire cross-section	0.08–2.5 mm²							
Operating temperature	-20 to +55 °C							
Storage temperature	-30 to +75 °C							
Ambient relative humidity	30–95 % non-condensing							
Ingress protection	IP20							
Position in 5 / 8–10 / 16 slots bus	3 / 6							

Technical specification of indirect DI cards

Card	DI20-UAS	DI20-UAM	DI20-UAL	DI20-UPS	DI20-UPM	DI20-UPL	DI20-UPX	DI20-UPXL	DI10-UPXL
Inputs number	20								10
Inputs type	Active (switching by dry contact)			Passive (switching by external voltage, both polarities)					
Level H	Closed	Closed	Closed	9–25 V	20–60 V	35–60 V	75–150 V	150–300 V	150–300 V
Level L	Open	Open	Open	0–4 V	0–10 V	0–17 V	0–20 V	0–60 V	0–60 V
Current in inputs	3.6 mA	2.4 mA	2.4 mA	2.5–7 mA	1.9–6 mA	1.7–3 mA	1.3–2.7 mA	1–2 mA	1–2 mA
SW filter for level H and L	0–16777.215 seconds, step 1 ms								
Allowed number of changes per minute	0–255								
Isolation voltage	3.75 kV AC for 1 minute								
Overvoltage category								CATIII/300V	CATIII/600V CATIV/300V
Consumption	2.2 W (half inputs active) max. 3.5 W (all inputs active)			0.5 W					
Connectors	2 × WAGO 231-311/026-000, part of delivery								
Wire cross-section	0.08–2.5 mm²								
Operating temperature	-20 to +55 °C								
Storage temperature	-30 to +75 °C								
Ambient relative humidity	30–95 % non-condensing								
Ingress protection	IP20								
Position in 5 / 8–10 / 16 slots bus	Any position								

RTU7M – digital outputs

General description

Digital output cards (DO) offer 10 relay outputs with eight NO contacts and two changeover contacts and they are produced in two variants for RTU7M:

- direct DO,
- indirect DO.

Digital output card

Direct DO

The direct digital output card is directly physically connected through power exciters to the digital outputs of the main processor of the RTU7M. A maximum of two cards can be fitted into the RTU7M bus. The advantage is the support of automation functions and the conditioned control (relay switching on the basis of the status of the inputs on the direct DI card).

Indirect DO

The indirect digital output card has its own processor which, through the signal exciter, switches the relay according to the stated requirements. The card behaves as a slave unit in the RTU7 series, data is transferred on an internal bus of the RTU7M, which serves as the communication bridge. The cards support the following communication protocols: IEC 60870-5-101, IEC 60870-5-104 and HIOCom2. Conditional control and automation functions are not implemented. The card enables the remote upgrading of FW.

Basic features

- 10 × relay DO 8 A/250 V AC or 8 A/24 V DC,
- 8 × NO contact, 2 × changeover contact
- HW and SW protection against accidental switching of output,
- adjustable time of closed contact,
- interference protection during switching of relay contact,
- special functions of some DO (thermostat control, protection).

Security of digital outputs

Great attention is focused on protection against accidental switching of the DO. It is resolved at two levels:

- SW level - a two-phase control of the relay switching is used. To be the command executed, the unit must receive two identical commands for switching of a relay in the stated time interval.
- HW level - each relay is controlled by two exciters. To perform the switching, both exciters must be activated at the same time. Each exciter is controlled by its own processor.

Special functions

Depending on the type of FW, some DO may have a reserved function. An example is the switching of the heating in the switchboard cabinet depending on the temperature measured by the external sensor, function for controlling of the power element during the evaluation of the earth fault, short circuit or overcurrent, etc.

Front panel of DO card

Technická specifikace karet digitálních výstupů

Card	DO10-D	DO10-U
Outputs number	8 × relay (NO contact), 2 × relay (changeover contact)	
Time of closed contact	10 ms to 655 with step 10 ms	
Isolation contact-coil	5 kV AC for 1 minute	
Isolation between open contacts	1 kV AC for 1 minute	
Contacts load	8 A/250 V AC, 8 A/24 V DC	
Durability	2 × 10⁷ cycles	
Relay switching	Protected against accidental switching. Controlled via digital signals from main CPU.	Protected against accidental switching. It is separated slave unit for RTU7 series.
Consumption	2.3 W	3 W
Connectors	2 × WAGO 231-311/026-000, part of delivery	
Wire cross-section	0.08–2.5 mm²	
Operating temperature	-20 to +55 °C	
Storage temperature	-30 to +75 °C	
Ambient relative humidity	30–95 % non-condensing	
Ingress protection	IP20	
Position in 5 / 8 /10 / 16 slots bus	3 / 4, 5	Any position
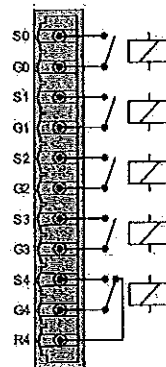
Output connectors wiring

▐ RTU7M – combined cards of digital inputs and outputs

General description

The card provides 10 digital inputs, 5 relay outputs with 4 normally open contacts and 1 changeover contact. Combined cards are produced only in the direct version, i.e. it is possible to fit only one card into the RTU7M chassis.
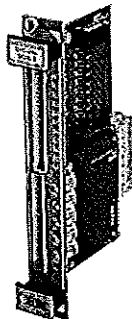
Combined card of digital I/O

Digital inputs

Digital inputs (DI) are galvanically isolated from the unit but there is no isolation between them. They are produced in two basic versions:

☑ direct DI, active,
☑ direct DI, passive.

Direct DI

This card has inputs directly connected to the CPU of the RTU7M. The processor then evaluates and filters the input signals, etc. The advantage is the support of automation functions such as conditioned control (relay switching on the basis of the status of the inputs on the direct DI card).

Active DI

Card is equipped with its own galvanically isolated voltage source. Input is excited after connection of input pin with external shared pin via external contact.
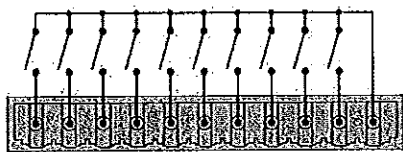
A0 A1 A2 A3 A4 A5 A6 A7 A8 A9 I-A

Active inputs connection

Passive DI

These inputs do not have the voltage source fitted. They are activated after connection of external voltage.
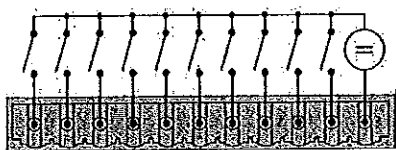
A0 A1 A2 A3 A4 A5 A6 A7 A8 A9 I-A

Passive inputs connection

Digital outputs

Relays are excited through power exciters directly from main CPU of RTU7M. The advantage is the support of automation functions and the conditioned control (relay switching on the basis of the status of the inputs).
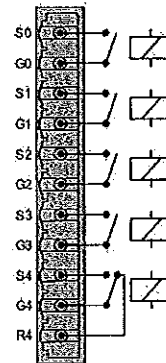
Outputs connection

Basic features

Inputs

☑ 10 × digital input with indication of input excitation,
☑ isolation 3.75 kV AC,
☑ time filter can be set up by SW for both logical levels,
☑ optional double-bit signaling
☑ configurable maximal allowed number of changes on input per time interval,
☑ input sampling with period 1 ms,
☑ impulse counter and period measuring with data storage into memory with backup.

Outputs

☑ 5 × relay 8 A@250 V AC / 8 A@24 V DC,
☑ 4 × normally open contact, 1 × changeover contact,
☑ HW and SW protection against accidental switching,
☑ adjustable time of closed contact,
☑ interference protection during switching of relay contact,
☑ special functions (thermostat control, protection).

Processing of input digital signals

DI are sampled with the period of 1 ms. The following step is filtration of the signal changes. The time filter can be set for both logical levels. If the change on the DI lasts the stated time, the stated logical level is declared valid and sent to the master system, if required. With each change, it is monitored the exceeding of the maximal set number of changes per minute. If the maximal number of changes is exceeded, the value is transferred with a telemetric error. This prevents the useless transfer of oscillating values.

Front panel of combined DO card

RTU7M – indirect analog inputs

General description

Indirect measurement cards are fitted with a powerful signal processor for processing of measured signals. In this case, the RTU7M unit serves only as a communication bridge for the data transmission. The advantage of these cards is the possibility to use more cards in one chassis in any position, the disadvantage is that it is impossible to use them for protective functions. After consultation with the manufacturer, it is possible to adjust the parameters of inputs.
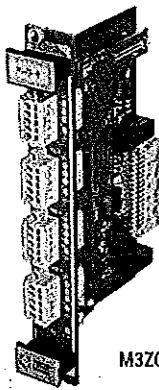
M3ZQ card

M3ZQ cards

In power industry applications these cards are used as indicators of short circuits, over-currents and earth faults. They are especially suitable for use in cable networks. In the case of three-phase alternating measurements, there are regularly calculated the effective values of currents in individual phases, effective value I_0 and average value of current I_{avg}. In addition, there is evaluated the exceeding of the parameterized limits for individual phase currents and the current 0. After exceeding of the limits during the stated period, there are signaled the earth fault, short circuit and the overcurrent. All inputs are galvanically isolated from the remaining part of the unit. Individual inputs are not galvanically separated between each other.

AI-xI a AI-xID cards

These cards are designed for the measurement of output DC current signals from sensors and measuring converters. They are produced with various input numbers (3, 6, and on request up to 9 or 12). All inputs are galvanically isolated from the remaining part of the unit. Individual inputs are not galvanically separated between each other. The measuring range can be parameterized in the RTU UC. Ranges 0 to 20 mA DC, 4 to 20 mA DC, -20 to +20 mA DC are available. Measurements of current are processed using a powerful signal processor. If the measured value is out of the parameterized range of measurement, it is transferred as invalid.
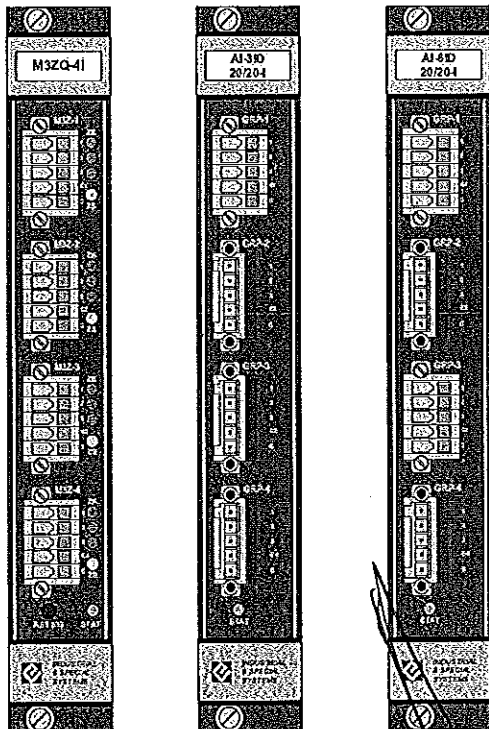
Front panels of indirect analog measuring cards (individual types of card use only connectors fitted by terminals)
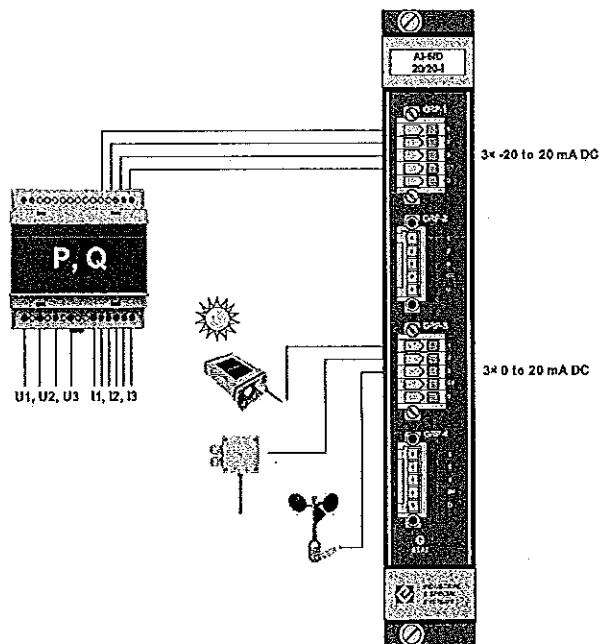
Example of connection of card AI-6ID with different measuring ranges of input groups

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RTU7M – combined indirect analog input cards

General description

Combined indirect analogue input cards are fitted with their own powerful signal processor for processing of the measured signals. Moreover, some types are fitted with their own digital inputs and outputs. The RTU7M unit serves in this case only as a communication bridge for the data transmission. According to the type and construction of the analogue inputs and the digital inputs and outputs, each card in this series is designed for specific application.

M3ZQ-xI cards

M3ZQ-AI card

This card is fitted with one group of 3-phase voltage inputs 1 V AC, one group of 3-phase current inputs 5 mA AC and six inputs 0 - 20 mA DC (+/- 20 mA DC). The card is designed, for example, for use in dispatch control applications and monitoring of renewable energy sources.

Analogue inputs in the first two groups are designed for connection to the modules of series EXT AI-MTI, EXT AI-MTU, which are fitted with measuring transformers for current or voltage. Analogue inputs in the further two groups (in total 6 analogue inputs) are primarily designed for the connection of sensors and converters of electric (P, Q) and non-electric values (temperature, exposure, etc.).

The three-phase measurement of currents and voltage in the first two groups of analog inputs are processed by the powerful signal processor on the card. Other values are calculated, e.g. U_{12}, U_{23}, U_{13}, P, Q, S, f, etc. The card does not provide protection or fault recording functions.

M3ZQ-BI card

This card is fitted with two groups of 3-phase current inputs 5 mA AC and two groups of 3-phase current inputs 20 mA AC. Individual inputs are galvanically isolated from the remaining part of the unit. Three-phase measurements of the current are processed by a powerful signal processor. For each 3-phase measurement, the functions of the indicators for short circuits, overcurrents and earth faults are supported. Optionally, for the evaluation of the short circuit and overcurrent, it is possible to activate filters for the first harmonic component of the measured signal. In the case of failure, the individual failure indicators provide failure records in the COMTRADE format or in a binary file.

M3ZQ card

Analogue inputs in the first two GRP-1 and GRP-2 groups are designed for connection to the modules of the EXT AI MTI series, which are fitted with measuring current transformers. Analogue inputs in the further two GRP 3 and GRP 4 groups are primarily designed for the connection of measuring transformers of currents with an output of 20 mA.
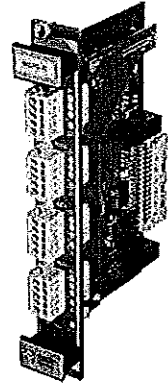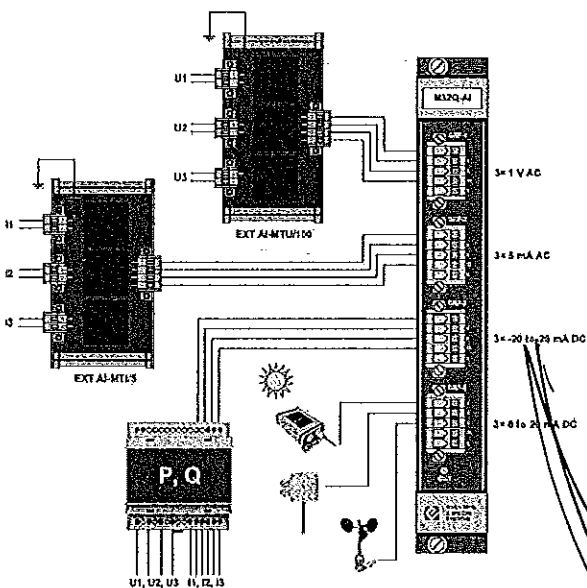
Example of connection of RTU7M M3ZQ-AI analog inputs, RES monitoring
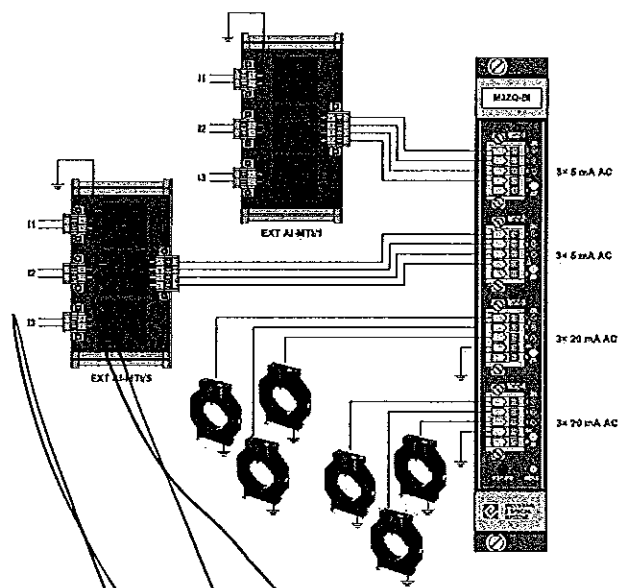
Example of connection of RTU7M M3ZQ-BI analog inputs

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EP cards

EP card without DI/DO with 3V and 3I measurement

This card is the basic type of card fitted with three voltage inputs with overloading of 1.2 (optionally 1.3 × U_n) and three current inputs with different overloadability according to the type of application. Nominal ranges are adapted to various types of measuring transformers of voltage (MTU) and current (MTI). The values in the overloaded ranges are also measured. In all cases, the maximal overloading (the robustness) of the analogue inputs is 100 A for 1 s.

Usually, the overloading about 2 × I_n is used in applications of P, Q, U, I measurement, the overloading 10 × I_n is used in applications like indicator of earth faults and short circuits and the overloading 30 × I_n is used in applications working as a protection of outlet.

Three-phase measurements of current and voltage are processed by a powerful signal processor. Other values are calculated, e.g. U_{12}, U_{23}, U_{13}, P, Q, S, f, etc. Both groups of inputs are galvanically isolated from the remaining part of the unit with 4 kV AC isolation for one minute. This isolation is also between both groups of analogue inputs and between individual current inputs.

The card provides two blocks of protective functions with the option of local and remote indication of faults and provides faults recording. From the protective functions, the functions 50, 51, 67, 50N, 51N, 67N are supported, along with voltage and frequency protection, current and voltage asymmetry and sensitive directional earth fault protection.

There are six programmable LED indicators on the front panel of the card that can be used for local signaling of faults. For the local reset of the signaling, it is possible to use the RST button whose function can also be programmed.

EP card with DI/DO with 4V and 4I measurement

Compared with EP cards without DI/DO, these cards are fitted with digital inputs and outputs and with analogue inputs for measurement of I_0 and U_x (for measurement of U_0 or other voltage variable). The card can serve as complete protection with the option to control the power element on the lines. Cards are produced with eight digital inputs and four digital outputs. Through the card parameterization, it is possible to set the source of measurement I_0 and U_0. The card can calculate I_0 and U_0 from the measurements of the phase currents and voltages or can measure them via fourth analogue inputs. This solution increases the sensitivity and accuracy of earth fault protection, if summation measuring current and voltage transformers are available.

Similarly to EP card without DI/DO, all protective functions are available, as well as fault recorder. In addition, automation functions for reclosing and disconnection in the voltage-free pause are available.

According to the type of the card, digital inputs are designed for various values of signaling voltages 24, 48, 110 and 220 V DC. They can be connected as active or passive.
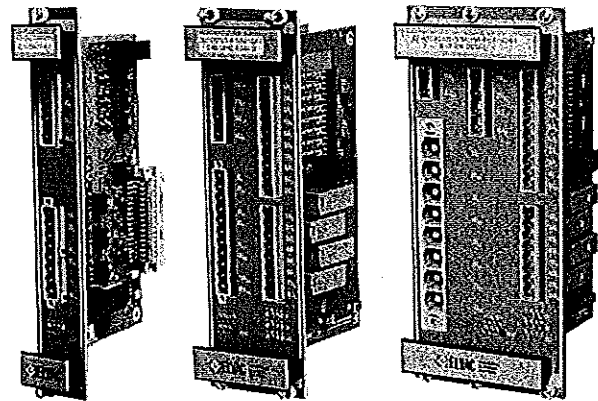
| Card EP 3U3I without DI/DO | Card EP 4U4I with 8DI 4DO | High current card EP 4U4I with 8DI 4DO |

According to the type of card, EP cards with DI/DO occupy two or three positions in the RTU7M chassis.

EP cards with special combinations of inputs

EP cards are designed with certain number of analog and inputs that can be combined according to the needs of customer. After consultation with the producer, it is possible to prepare special combination of voltage or current inputs adjusted to the specific range of sensors used in given application. This way were prepared for example following versions of cards for special purposes:

☑ **EP card for sensors FSI 36 and FSU 36**, which are used for example for sectionalizers. All analogue inputs on the card are voltage inputs and are galvanically isolated and divided into two groups which are also galvanically isolated. In the case of connection with current sensor FSI 36, the use of an external loading resistor is presumed. The fourth voltage input U_x is used for measurement of voltage U_a (voltage on A side of switching element, where is fitted the power supply transformer). All protective functions are available, as well as the automation functions and fault recorder.

☑ **EP card for capacitive sensors VSO 25** - three voltage inputs of this card are optimized for using with sensors VSO 25. The fourth voltage input U_x is used for measuring of voltage U_a. Four current inputs have nominal range 1 A with measuring up to 30 × I_n. These cards are typically used as control unit and protection for reclosers or sectionalizers (disconnectors).

☑ **EP card for Recloser GVR** - three voltage inputs of this card are optimized for using with converter 10 kV / 1 V, which is part of delivery of recloser GVR with capacitive sensors. The fourth voltage input U_x is used for measuring of voltage U_a. Four current inputs have nominal range 5 mA with measuring up to 30 × I_n. There are available all protective functions, automation functions a recorder of faults, similarly to all other types of EP cards with measuring of 4V 4I.

Other commonly used combinations of card are visible in table Ordering information (in the end of this chapter).
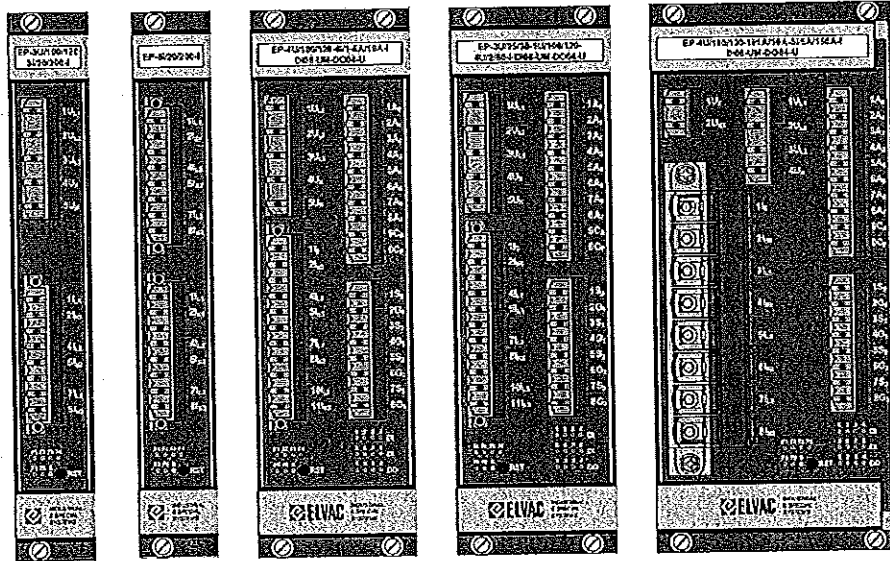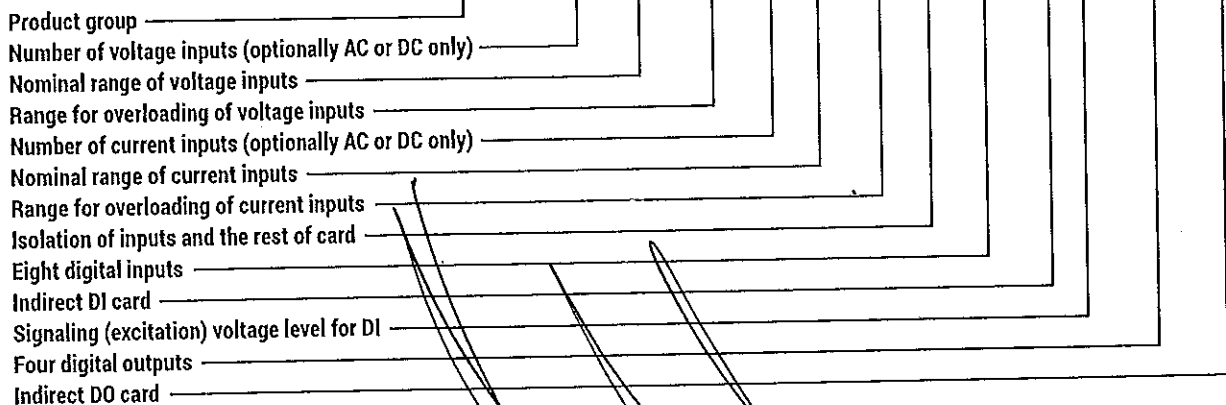
Examples of front panels of EP cards in 1-slot, 2-slot and 3-slot variant

Passive DI connection   Active DI connection   DO connection
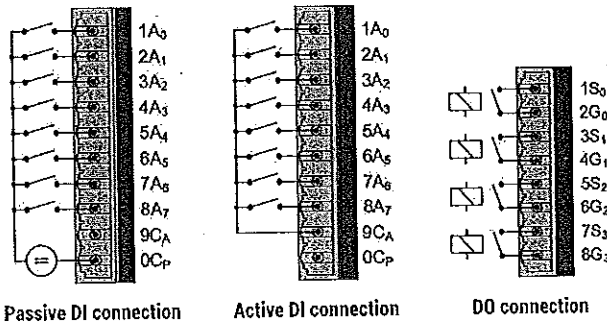
Product code description of EP cards

RTU7M EP-4U/100/120-4I/20/200-I-DI08-U M-DO004-U

Product group
Number of voltage inputs (optionally AC or DC only)
Nominal range of voltage inputs
Range for overloading of voltage inputs
Number of current inputs (optionally AC or DC only)
Nominal range of current inputs
Range for overloading of current inputs
Isolation of inputs and the rest of card
Eight digital inputs
Indirect DI card
Signaling (excitation) voltage level for DI
Four digital outputs
Indirect DO card

General parameters of EP cards

Signal processing	Its own processor, 16-bit A/D converter
Operating temperature	-20 to +55 °C
Storage temperature	-30 to +75 °C
Ambient relative humidity	30–95 % non-condensing
Ingress protection	IP20
Position in bus	Any position

Voltage inputs specification

Part of code	0.225/2.25	0.225/6.75	2/60	2.2/2.64	2.5/3
Inputs type	Isolation 4 kV AC for 1 min. from other parts of unit and secong analog inputs group.				
Nominal range	0.225 V AC ±0.225 V DC	0.225 V AC ±0.225 V DC	2 V AC±2 V DC	2.2 V AC±2.2 V DC	2.5 V AC
Overloadability	2.25 V AC perm. ±2.25 V DC perm.	6.75 V AC perm. ±6.75 V DC perm.	60 V AC perm. ±60 V DC perm.	2.64 V AC perm. ±2.64 V DC perm.	3 V AC perm.
Range in RTU UC	0–2.25 V	0–6.75 V	0–60 V	0–2.64 V	0–3 V
Input consumption	1 mW by 2.25 V	1.7 mW by 6.75 V	35 mW by 60 V	1 mW by 2.64 V	1.5 mW by 3 V
Measuring accuracy (nominal range)	±0.3 %	±0.5 %	±0.5 %	±0.3 %	±0.3 %
Measuring accuracy (overloaded)	±0.3 %	±0.3 %	±0.3 %	±0.3 %	±0.3 %

Part of code	3.25/3.9	25/30	100/120	230/295
Inputs type	Isolation 4 kV AC for 1 min. from other parts of unit and secong analog inputs group.			
Nominal range	3.25 V AC ±3.25 V DC	25 V AC ±25 V DC	100 V AC ±100 V DC	230 V AC ±230 V DC
Overloadability	3.9 V AC perm. ±3.9 V DC perm.	30 V AC perm. ±30 V DC perm.	120 V AC perm. ±120 V DC perm.	295 V AC perm. ±295 V DC perm.
Range in RTU UC	0–3.9 V	0–30 V	0–120 V	0–295 V
Input consumption	1.6 mW by 3.9 V	2 mW by 30 V	70 mW by 120 V	0.1 W by 295 V
Measuring accuracy (nominal range)	±0.3 %	±0.3 %	±0.3 %	±0.3 %
Measuring accuracy (overloaded)	±0.3 %	±0.3 %	±0.3 %	±0.3 %

Current inputs specification

Part of code	5/150	20/200	20/600	1.5A/10A	1A/30A	5A/150A
Inputs type	Current inputs group have isolation 4 kV AC for 1 min. from other parts of unit and voltage inputs group. Individual current inputs are isolated between each other.					
Nominal range	5 mA AC ±5 mA DC	20 mA AC ±20 mA DC	20 mA AC ±20 mA DC	1 A AC ±1 A DC	1 A AC ±1 A DC	5 A AC ±5 A DC
Overloadability	150 mA AC perm. ±150 mA DC perm. 0,5 A AC for 1 s ±0,5 A DC for 1 s	200 mA AC perm. ±200 mA DC perm. 2 A AC for 1 s ±2 A DC for 1 s	600 mA AC perm. ±600 mA DC perm. 2 A AC for 1 s ±2 A DC for 1 s	5 A AC perm. ±5 A DC perm. 10 A AC for 1 min. ±10 A DC for 1 min. 100 A AC for 1 s ±100 A DC for 1 s	8 A AC perm. ±8 A DC perm. 20 A AC for 1 min. ±20 A DC for 1 min. 100 A AC for 1 s ±100 A DC for 1 s	20 A AC perm. ±20 A DC perm. 150 A AC for 1 min. ±150 A DC for 1 min. 500 A AC for 1 s ±500 A DC for 1 s 1250 A peak for 100 ms
Range in RTU UC	0–150 mA	0–200 mA	0–600 mA	0–10 A	0–30 A	0–150 A
Input consumption	25 mW by 150 mA	35 mW by 200 mA	0.1 W by 600 mA	0.85 W by 10 A	5 W by 30 A	7 W by 150 A
Measuring accuracy (nominal range)	±0.5 %	±0.3 %	±0.5 %	±0.3 %	±0.5 %	±0.5 %
Measuring accuracy (overloaded)	±0.3 %	±0.3 %	±0.3 %	±0.3 %	±0.3 %	±0.3 %

ELVAC a.s. Hasičská 53, 700 30 Ostrava - Hrabůvka, Czech Republic
Tel.: +420 597 407 323, Fax: +420 597 407 102, www.rtu.cz

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Technical specification of digital inputs and outputs of EP cards

Part of code	DI08-UM-D004-U	DI08-UL-D004-U	DI08-UPX-D004-U	DI08-UPXL-D004-U
Inputs number	8			
Inputs type	Active (dry contact switching) Passive (switching by ext. voltage, both polarities)		Passive (switching by external voltage, both polarities)	
Level H of active DI Level H of passive DI	Closed 20–60 V	Closed 35–60 V	– 75–150 V	– 150–300 V
Level L of active DI Level L of passive DI	Open 0–10 V	Open 0–17 V	– 0–20 V	– 0–60 V
Input current of active DI Input current of passive DI	2.4 mA 1.9–6 mA	2.4 mA 1.7–3 mA	– 1.3–2.7 mA	– 1–2 mA
SW filter for level H and L	0–16777.215 seconds, step 1 ms			
Allowed number of changes per min.	0–255			
Isolation voltage	4 kV AC for 1 minute			
Outputs number	4 × relay (NO contact)			
Time of closed contact	10 ms to 655 s, step 10 ms			
Isolation contact-coil	5 kV AC for 1 minute			
Isolation between open contacts	1 kV AC for 1 minute			
Contacts load	8 A/250 V AC, 8 A/24 V DC			
Durability	2 × 10⁷ cycles			
Relay switching	Protected against accidental switching			
Connectors	1 × WAGO 231-310/026-000, 1 × WAGO 231-308/026-000, part of delivery			
Wire cross-section	0.08–2.5 mm²			

Ordering information (standard types available)

Card code	Use	PWR cons.	RTU slots
RTU7M EP-3U/100/120-3I/20/200-I	Measuring, indication on medium voltage lines, for split-core MTI 20mA	1.6 W	1
RTU7M EP-3U/100/120-3I/1-5A/10A-I	Measuring, indication on medium voltage lines, for MTI 1A or 5A	1.6 W	1
RTU7M EP-3U/100/120-3I/1A/30A-I	Measuring, indication on MV lines with higher overloadability, for MTI 1A	1.6 W	1
RTU7M EP-3U/230/295-3I/20/200-I	Measuring, indication on low voltage lines, for split-core MTI 20mA	1.6 W	1
RTU7M EP-3U/230/295-3I/1-5A/10A-I	Measuring, indication on low voltage lines, for MTI 1A or 5A	1.6 W	1
RTU7M EP-3U/2.2/2.64-1U/100/120-4I/5/150-I-DI08-UM-D004-U	Measuring, indication and protection, example of use - recloser GVR with capacitive sensors of voltage	3.5 W	2
RTU7M EP-3U/25/30-1U/100/120-4I/5/150-I-DI08-UM-D004-U	Measuring, indication and protection, example of use - recloser GVR with resistive sensors of voltage	3.5 W	2
RTU7M EP-3U/25/30-1U/100/120-4U/2/60-I-DI08-UM-D004-U	Measuring, indication and protection, example of use - sectionalizers with sensors FSU 36 and FSI 36	3.5 W	2
RTU7M EP-3UA/2.5/3-1U/100/120-4I/1A/30A-I-DI08-UM-D004-U	Measuring, indication and protection, example of use - sectionalizers with capacitive sensors VSO25, only AC measuring on capacitive inputs	3.5 W	2
RTU7M EP-3U/3.25/3.9-1U/230/295-1U/0.225/2.25-3U/0.225/6.75-I-DI08-UM-D004-U	Measuring, indication and protection, example of use - solutions for substations with sensors Zelisko	3.5 W	2
RTU7M EP-4U/230/295-4I/20/200-I-DI08-UM-D004-U	Measuring, indication and protection, example of use - LV substations	3.5 W	2
RTU7M EP-4U/230/295-4I/20/600-I-DI08-UM-D004-U	Measuring, indication and protection, example of use - LV substations	3.5 W	2
RTU7M EP-4U/230/295-4I/1A/30A-I-DI08-UM-D004-U	Measuring, indication and protection, example of use - LV substations	3.5 W	2
RTU7M EP-4U/100/120-4I/20/200-I-DI08-UM-D004-U	Measuring, indication and protection, example of use - MV substations	3.5 W	2
RTU7M EP-4U/100/120-4I/20/600-I-DI08-UM-D004-U	Measuring, indication and protection, example of use - MV substations	3.5 W	2
RTU7M EP-4U/100/120-4I/1-5A/10A-I-DI08-UM-D004-U	Measuring, indication and protection, example of use - MV substations	3.5 W	2
RTU7M EP-4U/100/120-4I/1A/30A-I-DI08-UM-D004-U	Measuring, indication and protection, example of use - MV substations	3.5 W	2
RTU7M EP-4U/100/120-1I/1A/10A-3I/5A/150A-I-DI08-UM-D004-U	Measuring, indication and protection, example of use - MV substations	3.5 W	3
RTU7M EP-6I/1A/30A-I	Measuring, indication, example of use - current measuring in substations	1.6 W	1
RTU7M EP-6ID/20/20-I	Example of use - general DC measuring from 20mA converters	1.6 W	1

Note: 1. The power consumption of EP card with passive DI (PX and PXL code) is 0.4 W lower than active versions.
2. Other combinations and input values can be delivered after consultation with producer.

Signaling and HMI panels

RIU

Panel SIG-D-EXTxx

General description

This panel is designed and adapted for mounting to the RTU7M modular units. It is fitted with LED indication, control buttons and switch for local and remote control. The panel is used in the power industry applications, mainly for remotely controlled disconnectors and remotely controlled reclosers. There are signaled the statuses of the disconnector, as error statuses on the lines, the communication and the backup battery statuses.

The panel is typically installed so that after opening the switchboard cabinet door, only this signaling and control panel is visible when passing through the sub-panel which covers the other electronic system, including RTU. As the panel is mounted directly on the RTU7M unit, it is not necessary to use the sub-panel if the user does not require it.

SIG-D-EXT can be connected to the RTU7M unit using the RS-485 line. The supply voltage for this panel is installed on the same communication line (RS-485). The panel can be supplied on client demand in a version where the signaling is solved using electro-magnetic flip dot signs instead the LED. In this case, the status after the RTU switch off remains displayed.
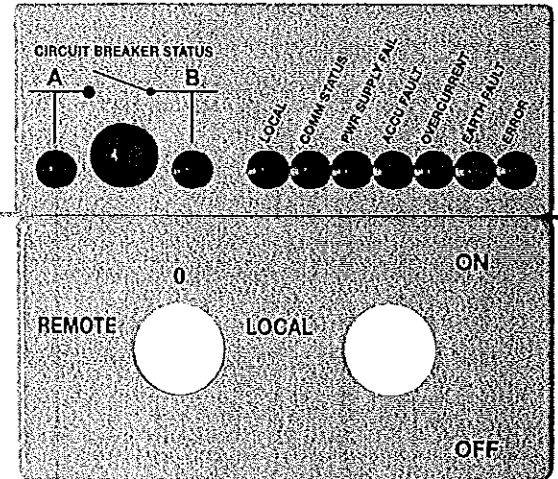
Signaling panel SIG-D-ETX
without fitted switch and buttons

Technical specification

Panel	SIG-D-EXT05	SIG-D-EXT12	SIG-D-EXT24
Number of LED	10 × LED (9 × red LED ø 5 mm and 1 × red-green LED ø 10 mm)		
Communication with RTU	RS-485		
External power supply	5 V DC	9–18 V DC (max. 3 W)	18–36 V DC (max. 3 W)
Consumption	1 W		
Connector	1 × WAGO 231-304/026-000, part of delivery; wire 0.08–2.5 mm²		
Operating temperature	-20 to +55 °C		
Storage temperature	-30 to +75 °C		
Ambient relative humidity	30–95 % non-condensing		
Ingress protection	IP20		
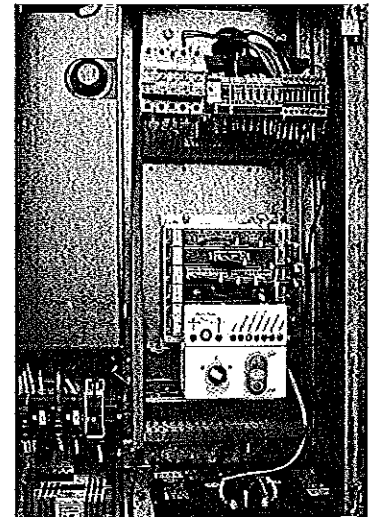
Example of application with signaling panel

Connector wiring of SIG-D-EXTxx

Pin	Description
+, -	Power supply
A, B	Signals of communication line RS-485
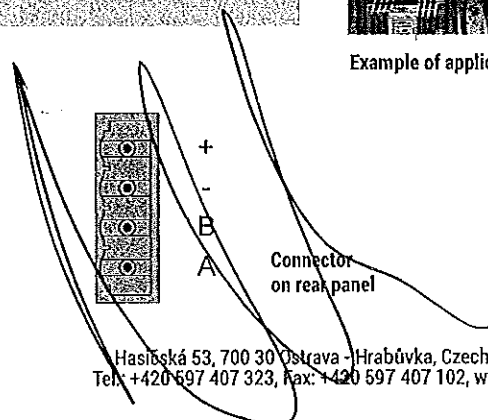
Panels ESP7

General description

Panel ESP7 – basic version

This panel is fitted with 22 LED, where the function can be configured using the standard parameterizing software supplied with RTU (RTU User center). The parameterization is carried out in the expressions editor. The RTU FW must be 105.02 or higher. The function of the individual LED can be set on the basis of the internal statuses of the RTU (digital inputs, digital outputs, analog inputs, virtual analog and digital inputs, internal statuses, etc.). Permanent on or off, fast or slow flashing, response delay, etc. can be set for each LED. The description of the LED functions on the front panel can be changed by the user using insert labels. This signaling panel is powered by the voltage which is available on RS-485 connector of the communication interface on the RTU7M. Thus it is not necessary to solve the backup of the power supply for the signaling panel. Interconnection is via a direct cable with RJ-45 terminals on the rear of the panel.
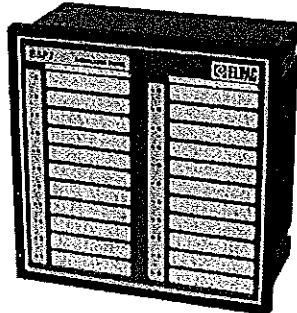
Panel ESP7 – serial line version

Panel ESP7-2ETH/F-230

This version of signaling panel contains the same number of signaling LED as the basic version, but it communicates with RTU via an Ethernet interface. The same options for individual LED setting and displaying are valid as in basic version. Unlike the basic version, this panel has the option of configuration via the web interface. The panel has two RJ-45 communication connectors - from the front part of the panel, the other from the rear (the panel works as a 2-port Ethernet switch). In the rear of the panel are a power supply connector and a reset button for the initial parameters setting of the Ethernet interface. The panel can be connected to all RTU7M, RTU7K/KL and RTU7.4 units that have an Ethernet communication interface. The panel can be supplied by DC or AC, see the table below.
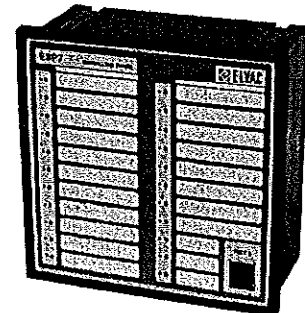
Panel ESP7-2ETH/F-230

Technical specification of ESP7 panels

Panel	ESP7	ESP7-2ETH/F-230
Status signaling	22 × LED (ø 3 mm, green)	22 × LED (ø 3 mm, green)
Communication with RTU	1 × RS-485	2 × Ethernet 10/100 Mbs (front + rear)
External power supply	5 V DC	90–260 V AC / 90–270 V DC
Consumption	Max. 1 W	Max. 11 W
Connectors	1 × RJ-45	2 × RJ-45, 1 × WAGO 231-302/026-000
Power supply wire cross-section	-	0.08–2.5 mm²
Dimensions	144 × 144 × 71 mm (W × H × D)	
Mounting hole dimensions	138 × 138 mm	
Max. thickness of the mounting sub-panel	Max. 5.5 mm	
Installation depth	64 mm (without connectors)	
Operating temperature	-20 to +55 °C	
Storage temperature	-30 to +75 °C	
Ambient relative humidity	30–95 % non-condensing	
Ingress protection	IP20 (optionally IP54 on front panel)	

Panel ERIC151x

General description

Panel ERIC is a user interface for ELVAC RTU. It is configured directly for specific RTU configuration used for control and measuring of outlets in substations and switching stations. It can be mounted into the hole in front panel (door) or on a rear mounting plate in switchboard cabinet, version 1516 also into 19" rack.

ERIC is equipped with touchscreen display, where the data from RTU can be read, especially measured values, messages from protections about faults on lines, eventually other information necessary for user. For local control in substations it is also equipped with set of switches, buttons and indicators, like cross for indication of switching element status and indicators of fault or outlet earthing.

Advantages:

- ☑ Full local control and information about section controlled via RTU.
- ☑ This solution can replace complicated cabling, which is often carried out on the door of cell/switchboard for indication and control of outlets.
- ☑ It can save the digital inputs in RTU, which are used for other variants of indication.
- ☑ Thanks to combination of data reading, displaying and control, there is possible to a certain extent to replace a local SCADA/HMI solution in affordable price. In some applications it can also eliminate computers, which are sensitive to the environment and handling.
- ☑ It indicates the fault on outlet (short circuit etc.).
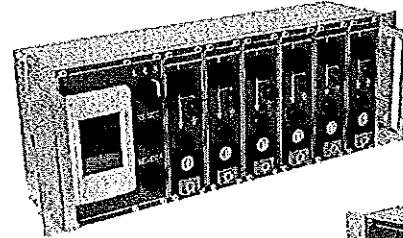
ERIC1516
for 19" rack mounting,
eventually into panel
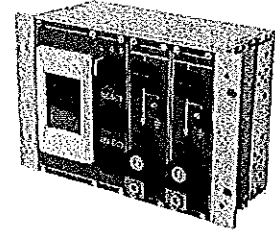
ERIC1512
for panel mounting

- ☑ Intuitive control, there is no need of training for operators.
- ☑ Industrial design, wide range of operating temperatures.
- ☑ It is not computer, thus it is not attractive for thieves.

Basic features of unit

- ☑ Communication with RTU through RS-485 (or Ethernet),
- ☑ external powering 24V DC,
- ☑ touchscreen display 2,8",
- ☑ switch for local and remote control,
- ☑ RESET button for reset of indication of fault on lines,
- ☑ SELECT button for enabling of control of switching element (it is necessary to press two buttons for control which prevents accidental manipulation),
- ☑ indication cross for active line indication,
- ☑ indication of outlet earthing,
- ☑ indication of fault, the source of fault can be read on display,
- ☑ switches On/Off for each switching element.

Technical specification of panels ERIC151x

Panel	ERIC1512	ERIC1513	ERIC1516
Number of controlled outlets	Max. 2	Max. 3	Max. 6
Consumption	Max. 5 W	Max. 8 W	Max. 12 W
Dimensions (W × H × D)	280 × 178 × 138 mm	332 × 178 × 138 mm	483 × 178 × 138 mm
Mounting hole dimensions	245 × 178 mm	297 × 178 mm	448 × 178 mm
Installation depth	106 mm		
Communication with RTU	1 × RS-485 (MODBUS)		
Connectors	1 × WAGO 4 pin (communication and power supply)		
External power supply	24 V DC		
Power supply wire cross-section	1.5–2.5 mm²		
Operating temperature	-20 to +70 °C		
Storage temperature	-30 to +75 °C		
Ambient relative humidity	30–95 % non-condensing		
Ingress protection	IP20		

RTU accessories

RTU
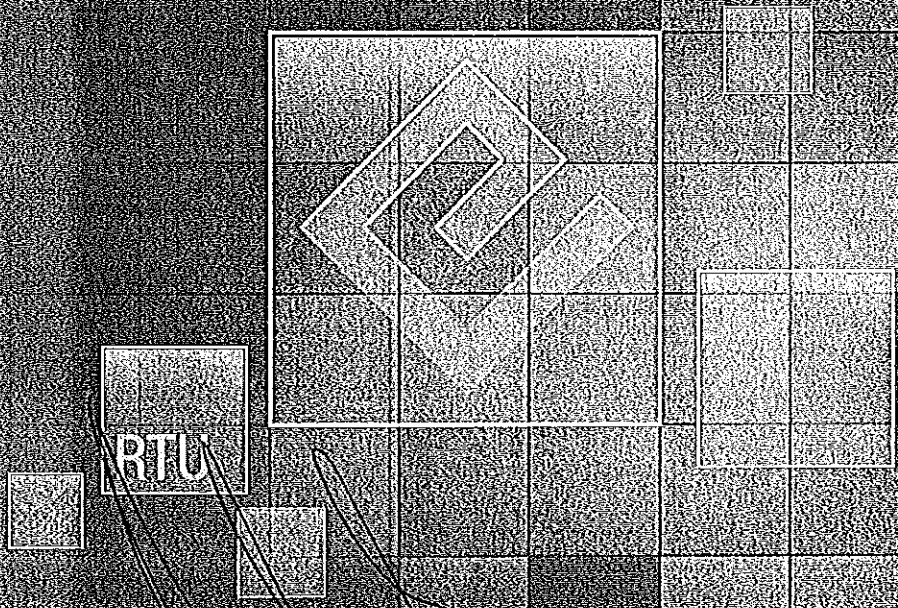
GSM and GPS antennas

ELVAC RTUs are used with GSM antennas with these types of connectors:

- ☑ FME – the most frequently used version by ELVAC RTU. The female antenna connector has an outside thread and the RTU has a male connector with an inside thread,
- ☑ SMA – male antenna connector with inside thread and the RTU has a female connector with an outside thread.

In addition to the required type of connectors, for the specification it is necessary to mention the following requirements for the type of antenna:

- ☑ antenna is fastened directly to RTU connector or through the cable with defined length,
- ☑ outdoor or indoor placement,
- ☑ type of fixation of the antenna rod - magnetic, screwed,
- ☑ a gain of the antenna in dB.

According to these specifications, we can provide the most suitable type of the antenna. The most frequently used types of GSM aerials are in the pictures.

GPS signal used in systems for time synchronization can be received through outdoor screw GPS antenna. An example is the type in the picture.
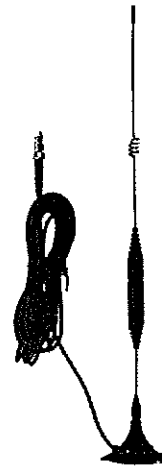
Magnetic GSM antenna 5dB
for indoor use
with connector FME
with length of cable 3 m

Screw GSM antenna 3dB
for outdoor use
with connector FME
with length of cable 4.5 m
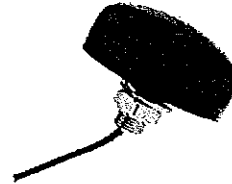
Screw GPS antenna 30 dB
for outdoor use with connector SMA
with length of cable 3 m

Backup batteries

ELVAC RTUs use lead acid batteries with the voltage 12V for backup. The capacity is chosen according to the system consumption and the operation time when powered from battery.

Two most frequently used types are shown in the pictures. The upper one shows the battery with capacity 7Ah used for backup of the separate RTU. The lower one shows the battery with capacity 28Ah used for powering the RTU including another devices, like motor of disconnector. These batteries are connected two into 24V backup.

We can provide for smaller types also battery holders for DIN rail or panel.
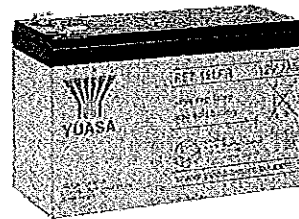
Battery 12 V/7 Ah
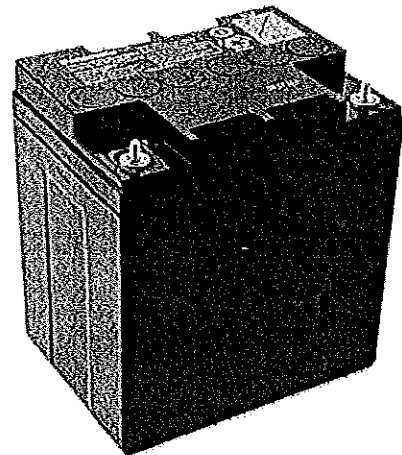
Battery 12 V/28 Ah
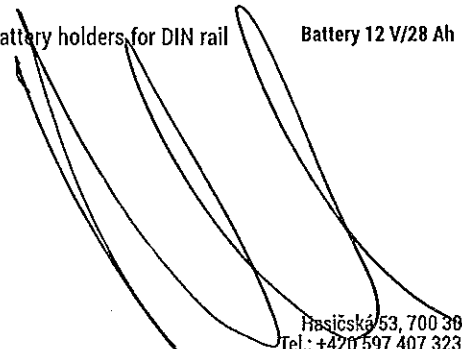
External power supplies

In some cases, due to various reasons regarding the RTU configuration, it is necessary to use an external power supply. We offer high-quality and reliable power supplies from verified brands.

Power supply 12 V for mounting on DIN rail
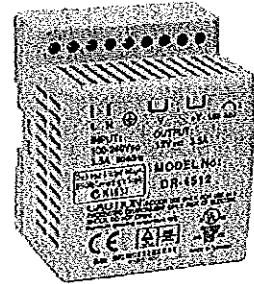
Measuring transformers, power supply transformers and sensors

In situations where the measured variable achieves values outside the range of measuring inputs, various types of transformers and sensors are used which modify the signal for the required range. We offer:

- power supply (interphase) transformers,
- measuring voltage transformers,
- measuring current transformers,
- measuring current transformers with split core,
- capacitive sensors for voltage measuring,
- Rogowski coils.

The measuring range of cards can be modified via external modules with the following labels:

- EXT AI-MTI for current measuring,
- EXT AI-MTU for voltage measuring.
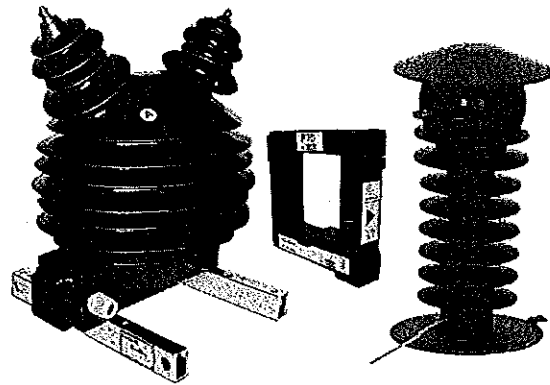
Examples (from left): Power supply transformer, measuring transformer with split core, capacitive sensor for voltage measurement.

Panel computers and HMI

In modern energy applications, there are requirements for high-quality visualization of monitored processes, simple control and setting of required parameters. Wide range of panel computers and HMI panels connected through Ethernet interface or RS-485 can be used for these purposes. The powerful processors with the required LCD displays with touchscreen, eventually with membrane keyboards for easy control, fully satisfy all requirements.

The offer includes a wide range of such products from various global brands. The specification can be fully adjusted to the stated application. The offer of panel PCs and HMIs is in the e-shop www.elvac.eu .
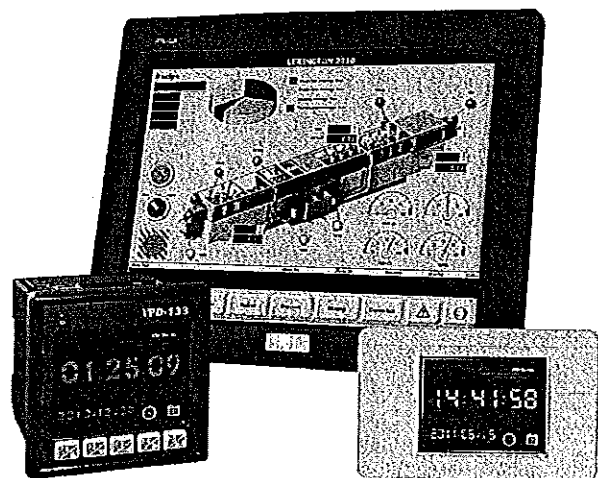
Examples of panel PCs and HMIs

RTU accessories
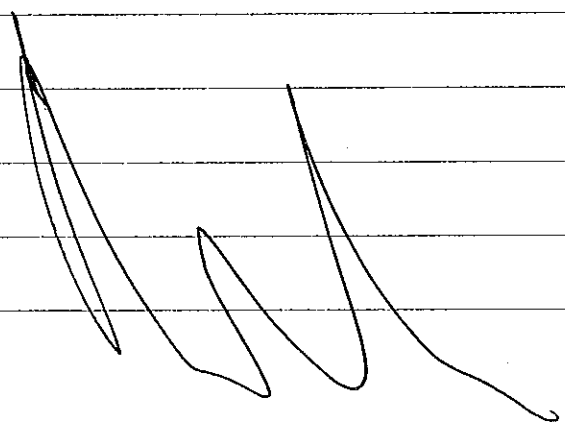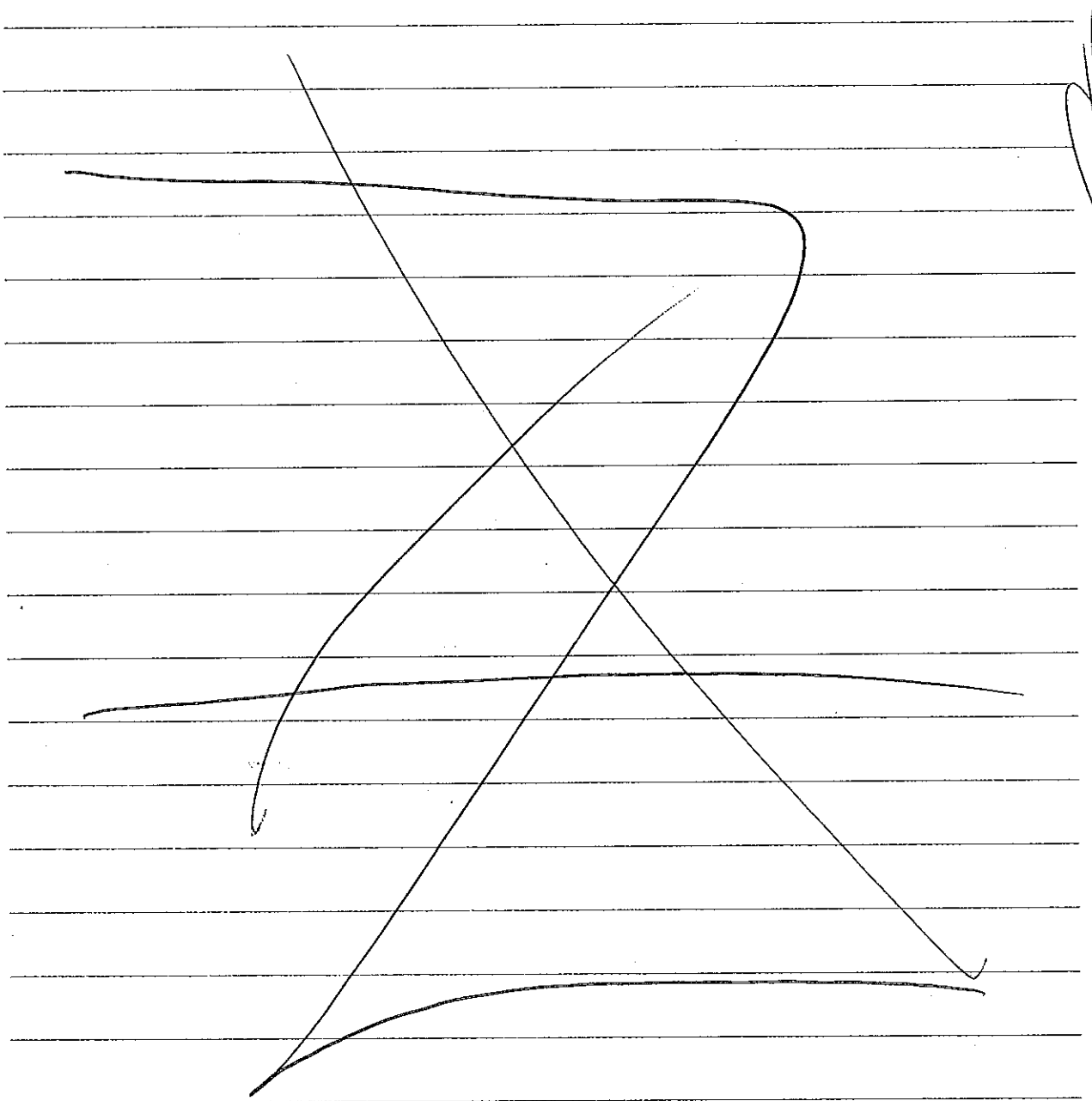
Testing devices
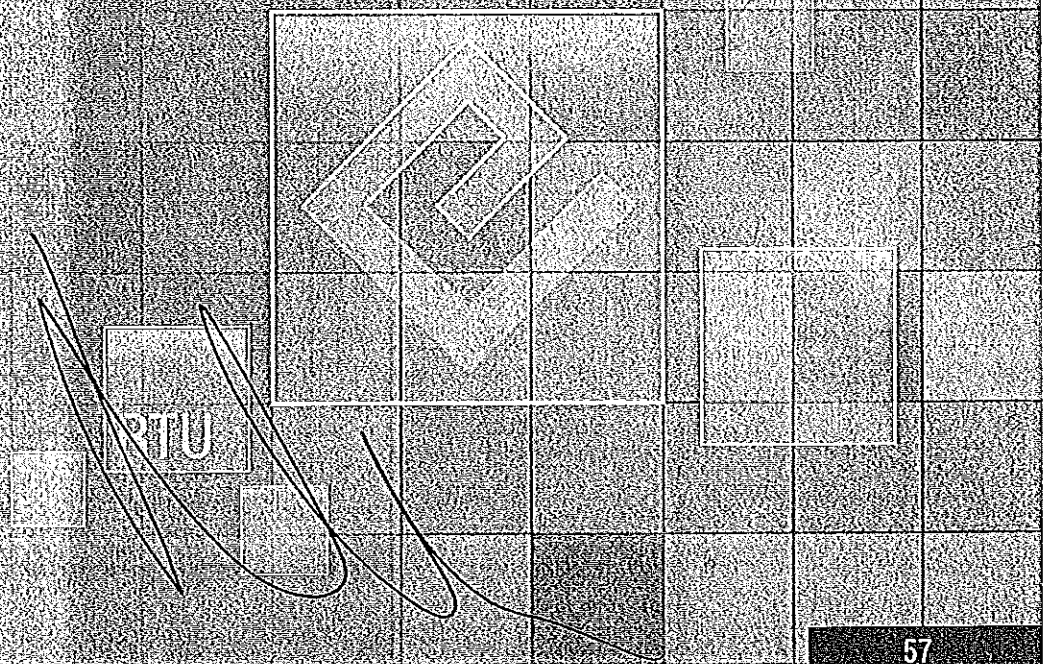
EPG7

EPG7

General description

The EPG7 is a compact generator of AC or DC three-phase currents in values up to the tens of mA primarily designed for testing of the correct functions of the measurements and protections of RTU units or other devices, where are the parameters of EPG7 suitable. The device can also be used as a simple process calibrator - the output current corresponds within the declared accuracy to the value shown on the display.

When fitted with a voltage card, the device can generate three-phase AC or DC voltage up to units of volts. There are 4 digital inputs and 4 digital outputs which can be used in advanced functions for testing of the protections.

All versions of the device are fitted with a 4-line LCD display with a rotary knob with an integrated control button. A USB interface is used for communication with the user SW. The analogue outputs, digital outputs, digital inputs and USB interface are galvanically isolated.

The device can be powered by 4 x AA NiMh batteries or from an external adapter. When powered from batteries, the operating time is approximately 2 hours (permanent generation of 45 mA AC currents on all outputs). The discharging of batteries is indicated by the LED diode. The internal fast charger has LED signaling of the charging process.

EPG7 ways of using

- currents generation, eventually voltage, AC / DC,
- P, Q generation
- phase to phase voltage setup,
- independent amplitude, frequency, phase setup for individual outputs,
- playing of records from protections (proprietary format REC from ELVAC RTU, COMTRADE),
- simulator of status of power element, including the interposition,
- optional control and reading of DI/DO,
- protection tests - current, earth, voltage, frequency,
- tests of fault currents indicators,
- test of reclosing,
- test of disconnecting in voltage-free pause,
- multichannel process calibrator.
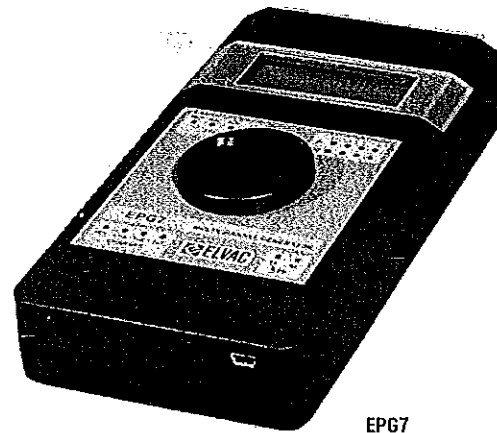
Basic features

- three-channel currents generator in range 0 to 45 mA AC and 0 to ±60 mA DC,
- in extended version three-channel voltage generator 0 to 7 V AC and 0 to ±10 V DC,
- analog output protection against overloading with indication,
- 4 × DI and in extended version 4 × DO for tests of protections
- alphanumeric LCD display and rotary knob with integrated button for easy control,
- powering from NiMH batteries or external adapter,
- integrated fast battery charger,
- USB 2.0 interface with galvanic isolation,
- wide range of user FW,
- optional user upgrade of FW according to demanded functionality,
- upper versions of FW can generate fault waveforms obtained from protections (format COMTRADE, proprietary format REC of ELVAC RTU),
- optional storage of generated waveforms in internal memory,
- upper function for tests of protection functions are in specialized FW,
- operating SW is available for PC.

Available HW variants of EPG7

Equipment according to variant	Basic	Advanced	Comfort
Current AC/DC outputs	3	3	3
Voltage AC/DC outputs		3	3
Digital inputs	4	4	4
Digital outputs		4	4
Batteries		4 × NiMH AA	4 × NiMH AA
Power adapter		230 V AC / 9 V DC	230 V AC / 9 V DC
Cables for signal connecting			Yes
Type of FW	Basic	Basic	Basic

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Description of available FW for EPG7

Basic

The basic version of FW can generate AC or DC currents. Fixed frequency 50Hz and phase shift 120° are set for AC waveforms. The user only changes the amplitude of the generated signal - the same in all three phases. There is the option to read DI. This SW module is always available.

Voltage generator

Generation of AC or DC currents and voltages. The other functions are the same as for the basic FW. In addition, the option to control and read DI/DO is available.

Function generator

It enables to set independent amplitudes, frequencies and phase shifts on individual voltage and current outputs.

Record player

Option to play fault records from protections (formats COMTRADE, proprietary REC) – requires SW on PC.

IPP tester

FW provides functions for automatic testing of the indicators of fault currents.

Protection tester

Automatic testing of protection in RTU units.

Individual modules can be mutually combined, according to the demand for the specific use. To activate, it is necessary to upload into the device the appropriate license bundled with the serial number (if the device is ordered together with the required configuration of FW modules, the appropriate licenses will be uploaded in the production).

EPG7

User SW for EPG7

User software EPGAP for PC (OS MS Windows) can be purchased for using of the EPG7 with maximum comfort. The basic functions include firmware updates and the uploading of license numbers for FW modules. The number of functions accessible from the user interface corresponds to the options of the EPG7 according to the license of FW. Besides the comfortable control of all parameters (amplitude, frequency, phase,...), it is possible, with the appropriate FW license, to download fault records from ELVAC RTU units in the REC format, or from any protection in the standard format COMTRADE, upload them into the generator memory and then to generate on its output. There is also the option to create own waveforms for specific testing purposes. There can be read from the generator an error statuses (diagnostics, checking of generated values is available) and timestamps of changes on digital inputs (DI data logger). The user interface also enables to set the digital outputs, eventually the parameters of the routines for automatic testing of the RTU units (including simulation of the response of the power element).

Bi-directional communication between the PC and the generator is ensured through an USB communication interface.
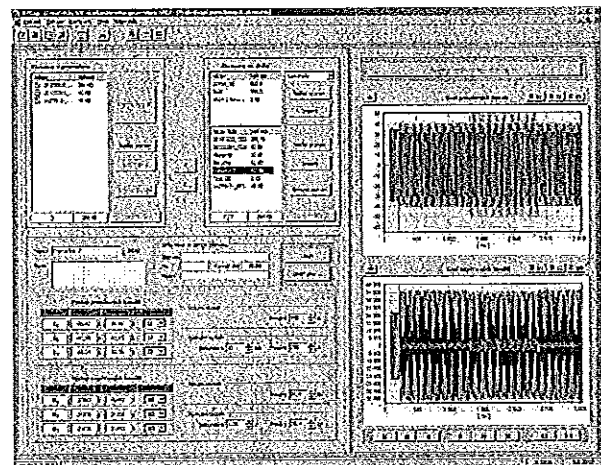
SW EPGAP

Summary of SW EPGAP functions

☑ Operating parameters setting of generator in remote control mode, setting of primary and secondary values conversion, generating of V and I,
☑ user parameters settings of device,
☑ work with fault records,
☑ formats REC and COMTRADE,
☑ records player,
☑ records storage in device,
☑ uploading of records from device,
☑ FW updates,
☑ support of all EPG7 functions, tests of protections and automatics.

Technical specification of EPG7 (according to the equipment of particular type)

Basic specification	
Display	LCD 16×4
Control	Rotary knob with integrated button
Power supply voltage	9 V DC
Input protection	polyswitch 2.5 A
Backup battery	4 × NiMH AA, capacity 2100 mAh max.
Charging current of battery	1.5 A
Battery protection	polyswitch 2.5 A
Dimensions	196 (207) × 100 × 40 mm
Weight	1 kg
Operating temperature	0 °C to +50 °C
Storage temperature	-20 °C to +75 °C
Ambient relative humidity	30-95 % non-condensing
Ingress protection	IP20

Current outputs		
Number	3	
Generated currents ranges	45 mA AC / ±60 mA DC	
Accuracy of generated currents	±0.1 % from range	
Load impedance	max. 100 Ω @ 45 mA AC	
Frequency of generated current	40–350 Hz	
Individual outputs phase shift setup	0–360 °	
Protection against current loop disconnection	Yes, indication of exceeding of maximal load impedance – LED AOF	
Signal processing	16 bit D/A converter	
Connectors	2 × WAGO 734-102, spacing 3.5 mm; part of delivery	
Wire cross-section	0.08–1.5 mm²	

Voltage outputs		
Number	3	
Generated voltages ranges	7 V AC / ±10 V DC	
Accuracy of generated voltages	±0.1 % from range	
Output current	max. 30 mA AC	
Frequency of generated voltage	40–350 Hz	
Individual outputs phase shift setup	0–360 °	
Overload protection	Yes, indication of low load impedance connection – LED AOF	
Signal processing	16 bit D/A converter	
Connectors	2 × WAGO 734-102, spacing 3.5 mm; part of delivery	
Wire cross-section	0.08–1.5 mm²	

Digital inputs		
Number	4 digital inputs	
Signaling voltage	12 V / 24 V	
Inputs configuration	Active (dry contact)	Passive (switching by external voltage, both polarities)
Level H	Close	11–40 V
Level L	Open	0–8 V
Input current	6.6 mA max.	2–6.6 mA; 3.3 mA @ 12 V
Isolation voltage	1.5 kV DC for 1 minute	
Connectors	2 × WAGO 734-108, spacing 3.5 mm; part of delivery	
Wire cross-section	0.08–1.5 mm²	

Digital outputs	
Number	4 digital outputs
Isolation voltage	3 60 Vrms for 1 minute
Switch loadability	1.5 A @ 35 V AC; 2.5 A @ 50 V DC
Resistance in close status	0.1 Ω max.
Connectors	1 × WAGO 734-108, spacing 3.5 mm; part of delivery
Wire cross-section	0.08–1.5 mm²

Communication interface	
Type	USB 2.0
Connector	Mini USB B, 5 pins
Isolation	4 kV for 1 minute

EPG7 HP

Basic features

- ☑ expansion of generator EPG7 by power outputs,
- ☑ designed for testing the correct function of protection and measurements in the standard ranges (100 V, 1 or 5 A),
- ☑ communication between the generator and the power module, transmission of ranges, calibration and error messages,
- ☑ easy transport in case with wheels, the device can be removed and placed on a table,
- ☑ optional external battery pack, converter for powering from 12 / 24 V.

Technical parameters

Current outputs	3 × max. 20 A AC
Voltage outputs	3 × max. 300 V AC
Amplitude control	0–100 % (signal from EPG7)
Frequency	40–350 Hz (signal from EPG7)
Angle between phases	0–360° (signal from EPG7)
Digital inputs	3 × optocoupler (from EPG7)
Digital outputs	3 × SSR (from EPG7)
Control and signaling	through EPG7
Communication	Connected with EPG7 through 1 × DI/DO
Powering	230 V AC, 50 Hz, optional converter from 12 / 24 V, optional battery pack
Dimensions	600 × 490 × 300 mm (case)
Weight	32 kg (with case)

EPG7 HP

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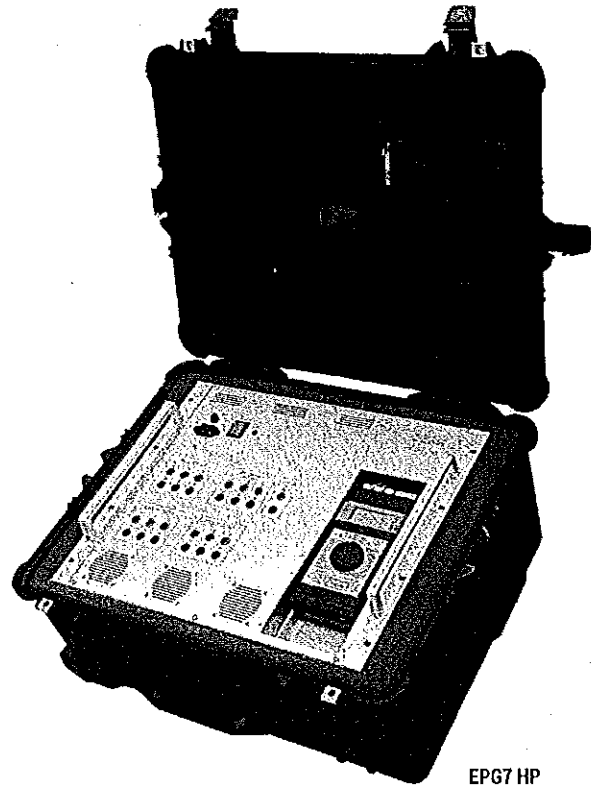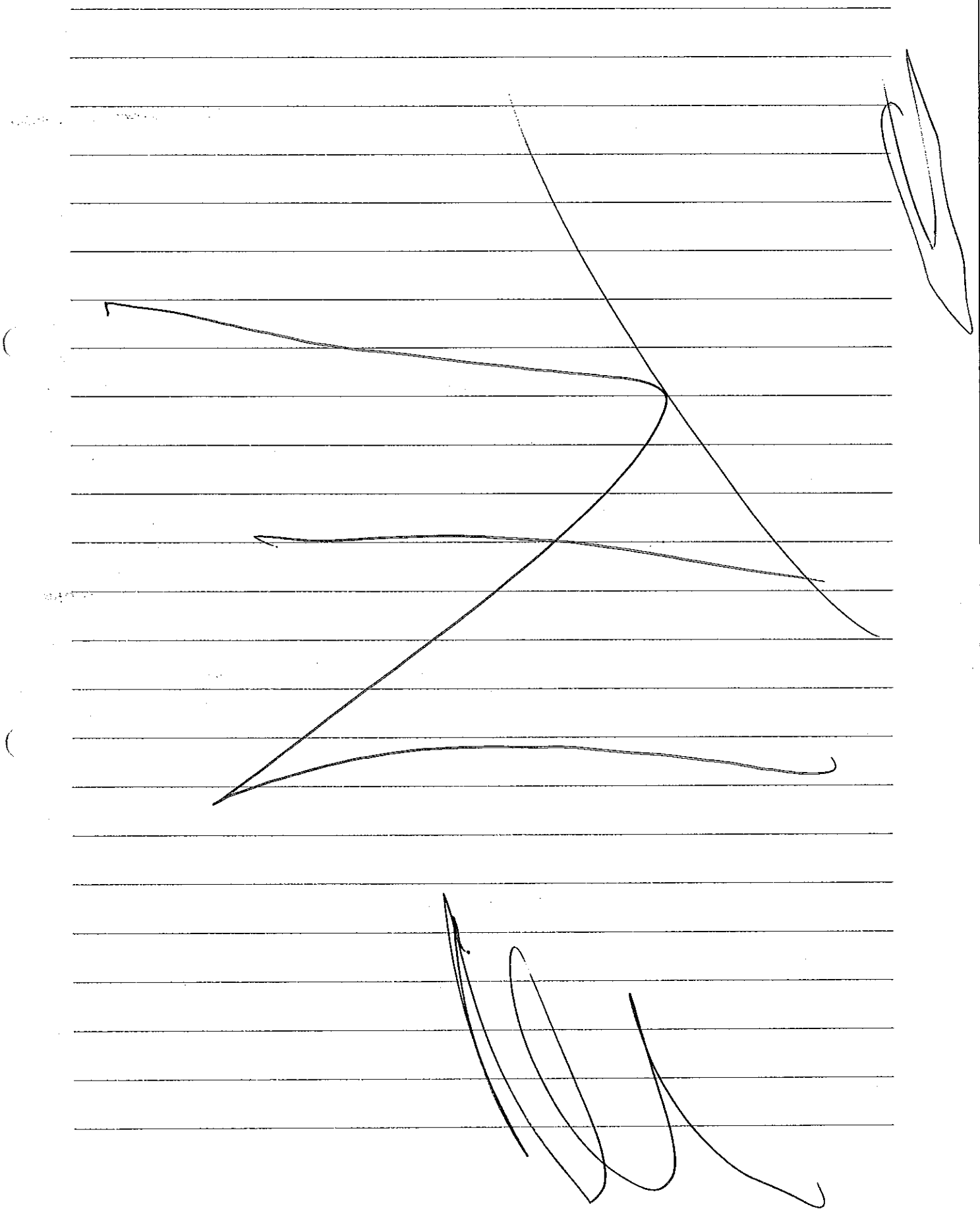
Redundant power supply RPS II

RTU
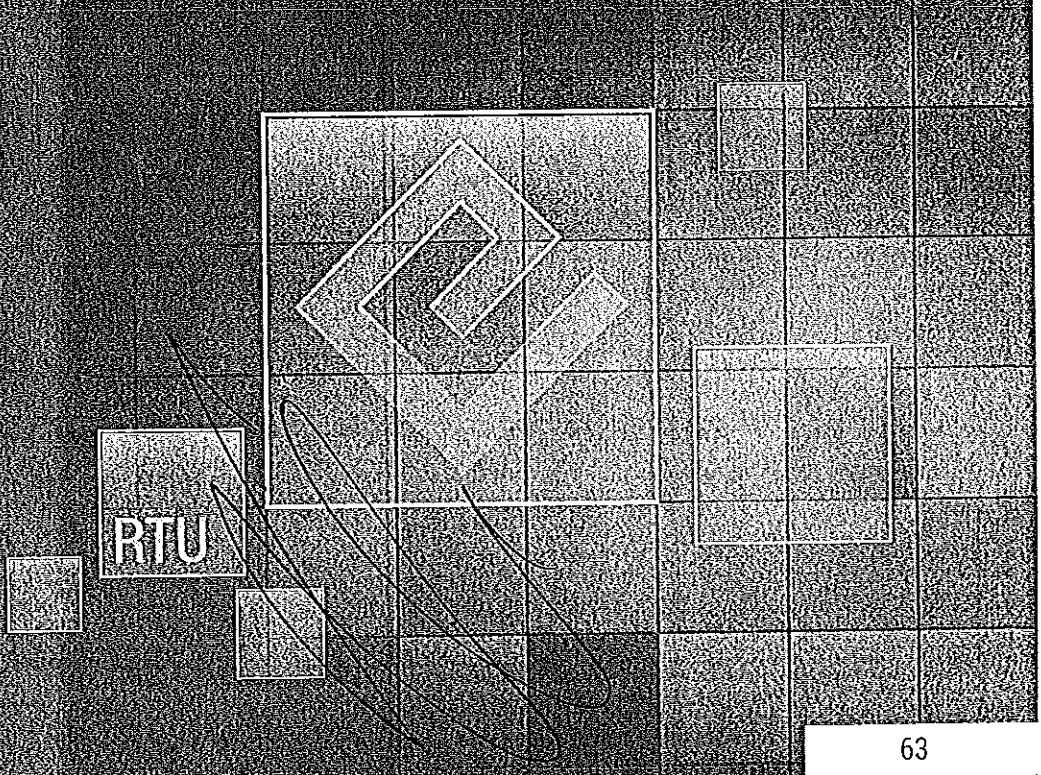
RPS II

General description

In many critical applications, the necessary requirement is to ensure a permanent power supply for key equipment irrespective of any breakdown in the electric network. This requirement is usually solved by power supplies with battery backup (UPS), although this is not the only possible and technically suitable solution. UPS ensures the delivery of energy only during the limited time depending on the capacity of batteries, while batteries are often the source of problems from long term point of view. Their capacity decreases in time and it is necessary to ensure a regular maintenance. The alternative for reliable powering of electronic control systems is powering from two independent sources of electric energy, eventually from one primary source and centrally managed battery backup. For this purpose has been designed the redundant power supply RPS II.

This power supply has fully modular concept with wide range of diagnostic functions. Two input modules serve for the connection of independent sources at various voltage levels. It allows the using of two sources at 230 V AC, as well as any other combination of AC or DC sources. Their task is also to ensure the galvanic isolation of individual inlets.

Up to four independent output modules can be fitted into the output positions. They ensure the conversion into needed voltage levels and also the overcurrent limitation, eventually another galvanic isolation for individual outputs.

All input and output modules can be replaced during the operation which enables to replace damaged modules or exchange with another type without the need to turn off the entire device. The unit is suitably completed by a diagnostic module in the version with an Ethernet or GSM interface for remote supervision and control of the device. The diagnostics provides information about the actual status of each module, value of the voltages and current consumptions. In addition, the ventilators in the box and the temperature on each module are checked.

The RPS II is the ideal power supply center for important technological equipment and devices.

Typical areas of use:

- ☑ control systems in energetics,
- ☑ control systems of important technology lines and machines in industry,
- ☑ telecommunication systems and industrial data networks,
- ☑ mobile measuring equipment (installation in vehicles, alternative power supply of 12/24 V DC or external inlet 230 V AC with optional switching during operation).
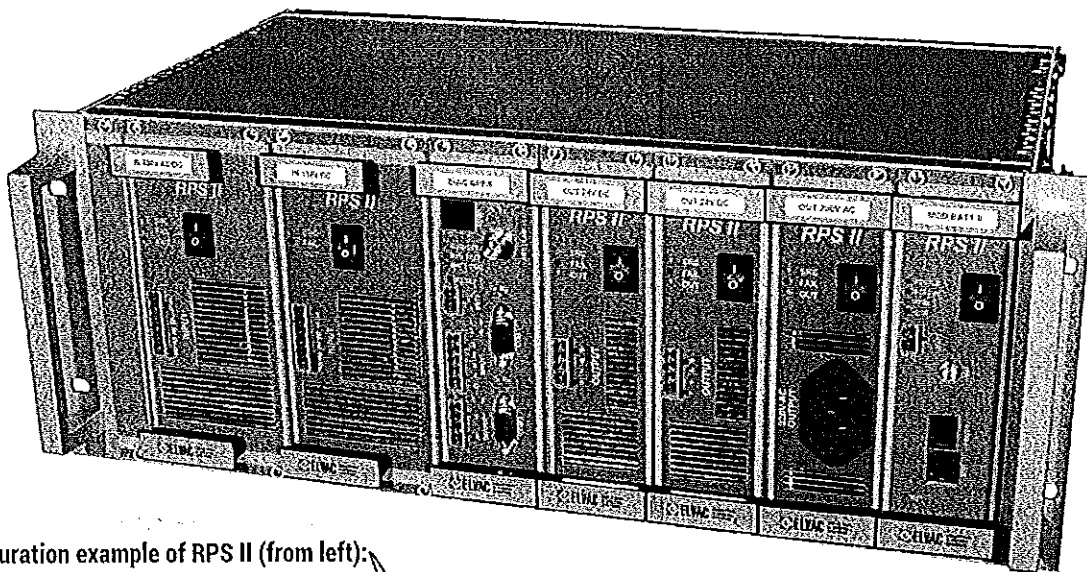
Configuration example of RPS II (from left):

- ☑ 2 x input cards with optional source voltage
- ☑ 1 x diagnostic and communication card
- ☑ 3 x output cards with optional output voltage
- ☑ 1 x special card with integrated GSM modem and backup battery for communication backup

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RPS II – chassis and bus

General description

The chassis and metal sheets are constructed from high-quality aluminum alloy with an anodizing surface treatment. The chassis has high mechanical stability and is designed for assembly into a 19" construction. In the chassis, which is fitted with a bus, is space for 7 modules. Input modules can be fitted into positions 1 and 2, while position 3 is designed for the diagnostic card and positions 4, 5, 6 and 7 are designed for output modules. The bus ensures the merging of the outputs of both input modules, the division of power between these modules in normal operation, separation of the disconnected or damaged module. From the merged 28.3 V voltage, the auxiliary 12 V voltage is stabilized which serves for the powering of thermally regulated ventilators and the control part of the output modules. 12 V is stabilized by two switching stabilizers in the redundant mode for increasing of the reliability (voltage 12 V A, 12 V B). If a diagnostic card is installed, the voltage values of 28.3 V, 12 V A and 12 V B are measured and transferred into the supervisory system. The maximum total permanent power supplied by all output modules connected to the bus is 250 W.

Basic features

- 2 positions for input power modules,
- 4 positions for output power modules,
- 1 positions for diagnostic card,
- width 19" (482.6 mm),
- height 4 U (177 mm),
- interior and exterior dimensions comply with IEC 60 297-3-101, 102, 103,
- EMC/EMI compatibility.
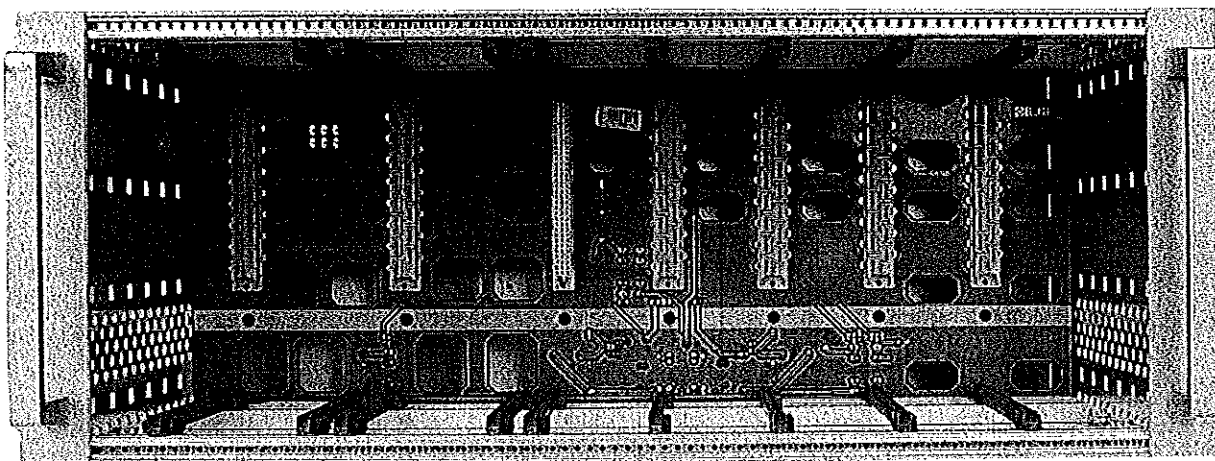
Bus in chassis of RPSII

Technical specification

Item	RPS II-CASE
Interior and exterior dimensions	Comply with IEC 60 297-3-101, 102, 103
Width	482.6 mm - 19" (84HP)
Height	177 mm - 4 U
Depth	245 mm
Consumption	Max. 15 W
Operating temperature	-20 °C to +60 °C
Storage temperature	-30 °C to +75 °C
Ambient relative humidity	30-95 % non-condensing
Ingress protection	IP20
Shock and vibration	According to IEC 61587-1, EN 50 155

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RPS II – input power supply cards

General description

The chassis of the RPS II can be fitted with two input power cards. These cards ensure the redundancy of the whole power supply. To keep the full redundancy, the total output load from these cards must not exceed 250W. The hardware ensures the equal division of power from input cards, if both are installed.

Cards are designed as Hot-Swap; this means that they can be changed during the operation of the power supply without affecting the function of the remaining cards. The cards are produced for a wide range of input voltages. Cards with various input voltages can be freely combined.

Input cards are fitted with DC/DC converters which transform input voltage to 28.3 V. In addition, the converters ensure galvanic isolation between input inlets and the 28.3 V voltage distribution on the bus. This voltage serves for powering of the power parts of the output and diagnostic cards. The input power supply cards communicate with the other cards via internal communication bus. Each input power supply card is fitted with its own measurement of the output current and voltage. This data is used for the built-in function of protection (short circuit, overcurrent, undervoltage and overvoltage).

The short circuit protection cannot be parameterized and is solved on the card using two methods. The first is the hardware solution, electronic current fuse. The second is the software solution where the short circuit is evaluated by the processor from the measurement of the output current and voltage. Over-current, under-voltage and over-voltage protection is evaluated from the measured current and voltage by the processor and can be parameterized from the supervisory system. It is also possible to enable or disable these protections.

Thermal sensor placed on the cards evaluates the temperature near the power elements and transfers the measured values to the supervisory system.

Basic parameters

- redundant mode,
- Hot-Swap,
- isolation input/output 2 kV AC (for 1 minute),
- power 250 W,
- measured output voltage, current and temperature,
- protective functions (overcurrent, short circuit, overvoltage and undervoltage),
- signaling LED for card status,
- remote control and monitoring (with diag. card),
- remote firmware upgrade (with diag. card),
- wide range of input voltages.
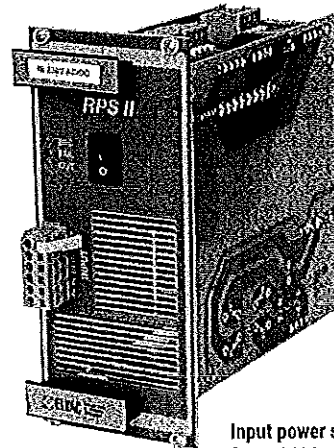
Input power supply card
for 230 V AC

Technical specification

Card	RPS II-IN 230 V AC/DC	RPS II-IN 24 V DC	RPS II-IN 48 V DC	RPS II-IN 110 V DC
Input voltage	230 V / 50 Hz AC (+/-10 %) 230 V DC (210-380 V DC)	24 V DC (20-30 V DC)	48 V DC (38-72 V DC)	110 V DC (90-170 V)
Input current	1.3 A (max. 2 A)	12.5 A (by 24 V DC)	6.25 A (by 48 V DC)	2.8 A (by 110 V DC)
Input protection	Fuse 5 A F	Fuse 25 A F	Fuse 20 A F	Fuse 10 A F
Output voltage	+28.3 V DC (250 W)			
Galvanic isolation	Input/output 2 kV AC (for 1 min.)			
Connector	WAGO 231-306/026-000			
Operating temperature	-20 °C to +60 °C			
Storage temperature	-30 °C to +75 °C			
Ambient relative humidity	30-95 % non-condensing			
Ingress protection	IP20			
Position in bus	1, 2			

RPS II – output power supply cards

General description

The chassis of the RPS II can be fitted with up to four output power supply cards (positions 4-7). The total maximum output load from these cards is 250 W while keeping full redundancy of input cards. The cards are designed as Hot-Swap. This means that they can be changed during the operation of the power supply without affecting the function of the remaining cards.

Each output power supply card is fitted with its own measurement of the output current and voltage - this data is used for the built-in protection functions (short circuit, overcurrent, undervoltage and overvoltage).

The short circuit protection cannot be parameterized and is solved on the card using two methods. The first is the hardware solution, electronic current fuse. The second is the software solution where the short circuit is evaluated by the processor from the measurement of the output current and voltage.

Overcurrent, undervoltage and overvoltage protection protects equipment connected to the output terminals of the card against exceeding the parameters, which can occur in the case of the failure of the card. This protection is evaluated from the measured current and voltage by the processor and can be parameterized from the supervisory system. It is also possible to enable or disable these protections.

Thermal sensor placed on the cards evaluates the temperature near the power elements and transfers the measured values to the supervisory system. The output power supply cards communicate with the other cards via internal communication bus.

Basic parameters

- Hot-Swap,
- measured output voltage, current and temperature,
- protective functions (overcurrent, short circuit, overvoltage and undervoltage),
- signaling LED for card status,
- remote control and monitoring (with diag. card),
- remote firmware upgrade (with diag. card).
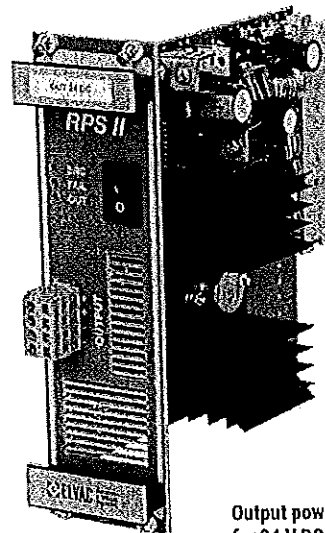
Output power supply card
for 24 V DC

Technical specification

Card	RPS II-OUT 12 V DC	RPS II-OUT 24 V DC	RPS II-OUT 24 V DC/I	RPS II-OUT 48 V DC/I	RPS II-OUT 230 V AC
Output voltage	12 V DC	24 V DC		48 V DC	230 V AC / 50 Hz (modified sine waveform)
Output current	1.5 A (18 W)	5 A (120 W)	3.75 A (90 W)	1.9 A (90 W)	0.4 A (90 W)
Tolerance	±3 %		±2 %		±5 %
Galvanic isolation	No		2 kV AC (for 1 min.)		No
Connector	WAGO 231-304/026-000				EURO outlet
Operating temperature	-20 °C to +60 °C				
Storage temperature	-30 °C to +75 °C				
Ambient relative humidity	30-95 % non-condensing				
Ingress protection	IP20				
Position in bus	4, 5, 6, 7				

▌ RPS II – diagnostic card

General description

The RPS II can be fitted with the diagnostic card with many functions and built-in peripherals. As a concept, the card is derived from RTU units produced by ELVAC, a.s. Like with other modules, the card communicates with the surroundings through the proprietary protocol HioCom2.

The function of the diagnostic card is to monitor the internal supply voltage on the bus in chassis RPS II, the revolutions of ventilators in the chassis, and to control the charging of the backup battery (external or on the MOD BATT module). In addition, the diagnostic card enables the supervisory system to communicate with individual cards, and enables the remote monitoring and control of cards.

The following peripherals are fitted on the diagnostic card:

☑ 2 digital outputs (contact relay NO)
☑ 4 digital inputs (active, 24 V, other configurations are possible)
☑ input for external thermal sensor
☑ 2 serial, galvanically isolated ports

Using peripherals, it is possible to control, monitor and communicate with other equipment in the technology. The powering of the diagnostic card module is backed up by a battery which can be external or located on the MOD BATT module directly in the chassis of RPS II.

The diagnostic card can be fitted with various communication interfaces such as GPRS, Ethernet, or others according to request of the client (RS-232, RS-485, CLO, optical).

Basic parameters

☑ Hot-Swap,
☑ interfaces GPRS/Ethernet,
☑ 4 digital inputs,
☑ 2 digital outputs,
☑ internal and external thermal sensor,
☑ 2 × serial galvanically isolated port,
☑ monitoring of bus voltage and fan speed,
☑ backup battery charging control (12 V),
☑ signaling LED for card status,
☑ enables supervisory system to communicate with individual cards,
☑ enables the remote control and monitoring of cards,
☑ remote upgrade of firmware.
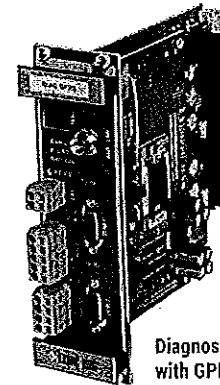
Diagnostic card
with GPRS interface

Technical specification

Card	RPS II-DIAG GPRS	RPS II-DIAG NET
Communication interface with supervisory system	GSM/GPRS	Ethernet
Digital inputs	4 × active (dry contact), input current 5.9 mA, galvanic isolation 3.75 kV AC (for 1 min.), signaling of excitation 4 × LED	
Digital outputs	2 × relay, contact NO, max. switching voltage 30 V DC / 250 V AC, max. switching current 5 A, galvanic isolation 3.75 kV AC (for 1min.), signaling of excitation 2 × LED	
Serial ports	2 × RS-232 (TxD, RxD), connector Canon DB9/F, galvanic isolation 1 kV AC (for 1 min.)	
Other interfaces	Connector for external thermal sensor	
Backup battery charger	12 V/0.3 A (charges to max. voltage 13.8 V)	
Consumption	Max. 100 mA	
Connectors	FME, WAGO 231-302/026-000, 231-304/026-000, 231-305/026-000	RJ45, WAGO 231-302/026-000, 231-304/026-000, 231-305/026-000
Operating temperature	-20 °C to +60 °C	
Storage temperature	-30 °C to +75 °C	
Ambient relative humidity	30-95 % non condensing	
Ingress protection	IP20	
Position in bus	3	

RPS II – special cards

ELVAC, a.s. while aiming to meet client demands, constantly expands its product portfolio. The result is, among others, an expansion of product line of output cards for the RPS II by special cards. These cards are a specialized devices which have different function than power supply but they use the advantage of redundant power supply which is provided by input modules fitted in the RPS II chassis and the compact character of such solution. Another advantage is the option of remote control if the diagnostic card is installed.

RPS II – MOD BATT

General description

MOD BATT is a special output card which integrates the GSM/GPRS modem with the RS-232 interface together with the backup battery which is designed for backup of the diagnostic card. The chassis of the RPS II can be fitted with one to four MOD BATT modules. If the chassis is fitted with a diagnostic card, the card RPS II–MOD BATT provides the supervisory system with information about the supply voltage of the GSM/GPRS module, temperature of the battery, switch status, modem status and the position of the module in the chassis.

Basic features

☑ Hot-Swap,
☑ GSM/GPRS/EDGE modem with RS-232,
☑ backup battery for diagnostic card,
☑ internal thermal sensor,
☑ signaling LED for card status,
☑ remote control and monitoring (with diag. card),
☑ remote upgrade of firmware (with diag. card).
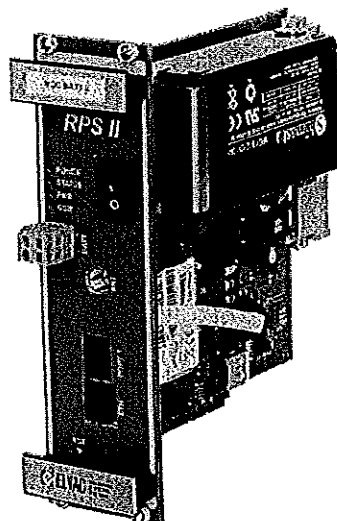
Card MOD BATT

Technical specification

Card	RPS II-MOD BATT
Modem	GSM/GPRS modem (Enfora Enabler II-G)
Serial port	RS-232 (TxD, RxD, RTS, CTS, DTR, DSR, RI, CD), connector Canon DB9/F, ESD protection on all lines 15 kV
Backup battery	Lead acid battery 12 V/1.3 Ah (WP1.3-12)
Consumption	Max. 150 mA
Connectors	FME, WAGO 231-302/026-000
Operating temperature	-20 °C to +55 °C
Storage temperature	-30 °C to +75 °C
Ambient relative humidity	30-95 % non-condensing
Ingress protection	IP20
Position in bus	4, 5, 6, 7

RPS II – accessories

Technické parametry

Type	Description
RPS-OUT230 CAB	90 cm cable for connection of card RPS II-OUT 230 V AC with device powered from 230 V AC
RPS-BATT CAB	60 cm cable for connection of card RPS II-DIAG and RPS II-MOD BATT.
RPS-COM CAB	2 m communication cable (RS-232) for connection of RPS II and PC
RPS-CAB-24	1.4 m cable for connection of card RPS II-OUT 24 V DC with device powered from DC
RPS-MCS CAB	1 cable for connection of card RPS II-OUT 24 V DC with system MCS
RPS-TEMP CAB	2 m cable with thermal sensor for connection to RPS II-DIAG.
Antenna	GSM dual antenna, magnetic, 5 dB, connector FME (f)

Other electronics
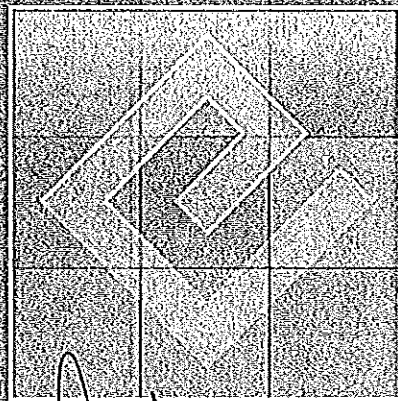
RTU

Diagnostic card MPC3

Diagnostic module for chassis
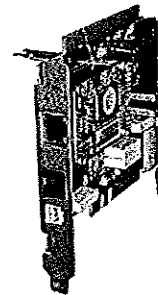
Expansion card for communication

General description

The MPC3 card is designed for remote monitoring of the status of the PC. In the basic version, it is a diagnostic module installed in the chassis of the computer which monitors and indicates the status of key functions of the computer. In the expanded version, the PC can be fitted with the communication card for remote monitoring.

It can be used either together with the expanding SNMP agent for the Windows system (available free of charge), or directly controlled by the RTU Communication set, which enables access to data by means of standard interfaces for further user applications.

Basic features

- ☑ temperature measurement,
- ☑ fan speed measurements,
- ☑ 6× measurement of DC voltage on power supply,
- ☑ signaling of status by LED,
- ☑ galvanically isolated binary inputs,
- ☑ communicates via serial interface RS-232, Ethernet or GSM/GPRS,
- ☑ four free I/O pins,
- ☑ optical or acoustic signaling of statuses,
- ☑ powered directly from bus or standard PC connector.

Function description

Temperature measurement
Up to four thermal sensors can be connected.

Fan speed measurement
The module is fitted with eight connectors for fans and forwarding the information about the fan speed to the mainboard. Four LEDs provide the indication of the status.

Voltage measurement
Four inputs for the measurement of positive voltage and two inputs for negative voltage are available (max. 15 V). Their status is merged into one signaling LED.

Binary inputs
Two digital inputs are designed for reading of the status of the redundant power supply. The inputs are optically isolated. A voltage of 2 V with any polarity is required for switching on. The statuses of these inputs are indicated by LED 8 and 9.

Communication
Expanded version can provide a data through a serial line, Ethernet or GSM modem.

Technical specification

Card	MPC3 (basic version)	MPC3 (expanded version)
Internal temperature measurement	4 × internal thermal sensor	
Measured range of int. temperatures	-40 °C to 125 °C, accuracy ±1.3 °C in range 25 °C to 85 °C	
External temperature measurement	-	1 × external thermal sensor
Measured range of ext. temperatures	-55 to 125 °C, accuracy ±0.5 °C in range -10 °C to 85 °C	
Fan speed measurement	4 × fan with OC output	
Voltage measurement	4 × input for positive voltage and 2 × input for negative voltage measurement (max. 15 V resp. -15 V)	
Redundant PS status check	2 × binary inputs PWR, sensitivity 1.5 V-5 V (information connected from redundant power supply)	
Digital inputs		1 digital input passive; level L 0-4 V, level H 8-28 V (optionally active or other voltage)
	-	1 × ALARM, 2 × NO contacts (relay 50 V/1 A AC/DC)
Function WDT		Yes, 1 × contact for reset of device
Communication with supervisory system	-	Optionally Ethernet, RS-232, RS-485, GSM/GPRS
Optical signaling	10 × two-color LED (4 × fans, 2 × temperature, HDD, voltage, 2 × redundant power supply)	
Sound signaling	1 × buzzer (can be turned off)	
Powering	5 V and 12 V from PC (from external PS)	
Consumption	1 W	3 W
Montage	4 × mounting hole, diameter 3.2 mm	PCI, PCI Express, ISA
Dimensions	168 mm × 82 mm	109 mm × 100 mm
Further information	Speaker 40 × 40 mm 8 Ohm, 0.2 W	
Operating temperature	-20 °C to 55 °C	
Storage temperature	-30 °C to 75 °C	
Ambient relative humidity	30-95 % non-condensing	
Ingress protection	IP20	

Universal USB converter CONV7

General description

The CON7 universal USB converter serves as a carrier for the CIOMOD communication module series and converts USB communication to various physical interfaces. The communication runs through the Virtual COM port drivers. The installed communication interface (CIOMOD module) is mapped in the OS as a serial line. Individual modules can be easily replaced according to the actual demand for the physical communication interface.

The CONV7 converter can be used as a service communication interface between the PC with the User Centre and the RTU7x series.

The delivery includes a 1m USB cable, CD with drivers, user manual and set of replaceable covers for various types of modules. An aerial is included for the CONV7-GSM with the CIOMOD-GSM module.

Individual CIOMOD series modules can be ordered separately.
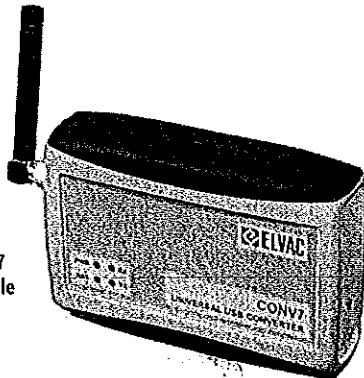
Converter CONV7
with GPRS module

Basic features

- ☑ communication USB converter for various physical interfaces (replaceable by user),
- ☑ carrier for all CIOMOD modules,
- ☑ USB 2.0 Full Speed compatible,
- ☑ galvanic isolation 2 kV AC (with modules CIOMOD-232 and CIOMOD-485),
- ☑ ESD protection on USB interface side,
- ☑ ESD protection on CIOMOD modules,
- ☑ transfer rate 300 bps up to 1 Mbps with modules CIOMOD-232 and CIOMOD-485),
- ☑ with CIOMOD-GSM can be used as an USB (E)GPRS modem.

Support in OS

Virtual COM Port drivers are available for these OS:
- ☑ Windows XP, Windows Server 2003, Windows Vista, Windows 7, Windows Server 2008, Windows Server 2008 R2 and Windows 8/8.1,
- ☑ Windows Mobile 2003, Windows Mobile 2003 SE, Windows Mobile 5, Windows Mobile 6, Windows Mobile 6.1, Windows Mobile 6.5, Windows CE 6.0,
- ☑ Mac OS X,
- ☑ Linux (drivers are part of core from version 2.6.31).

Technical specification

USB interface	USB 2.0 Full Speed compatible
Connector	USB B
Consumption from USB port	Max. 500 mA (max. 1 A with module COMIO-GSM)
Isolation	2 kV AC for 1 minute (for modules CIOMOD-232 and CIOMOD-485)
Transfer rate	300 bps – 1 Mbps (for modules COMIO-232 and COMIO-485)
Drivers	Windows, Linux, Mac OS (see text)
Operating temperature	-20 °C to +55 °C
Storage temperature	-30 °C to +75 °C
Ambient relative humidity	30-95 % non-condensing
Ingress protection	IP20
Dimensions	94.5 x 63 x 28 mm
Weight	0.1 kg

Ordering information

Type	Description
CONV7-UNI	USB converter without module CIOMOD
CONV7-232	USB converter with module CIOMOD-232
CONV7-485	USB converter with module CIOMOD-485
CONV7-GSM	USB converter with module CIOMOD-GSM ((E)GPRS modem)
CONV7-OPT	USB converter with module CIOMOD-OPT
CONV7-BT	USB converter with module CIOMOD-BT
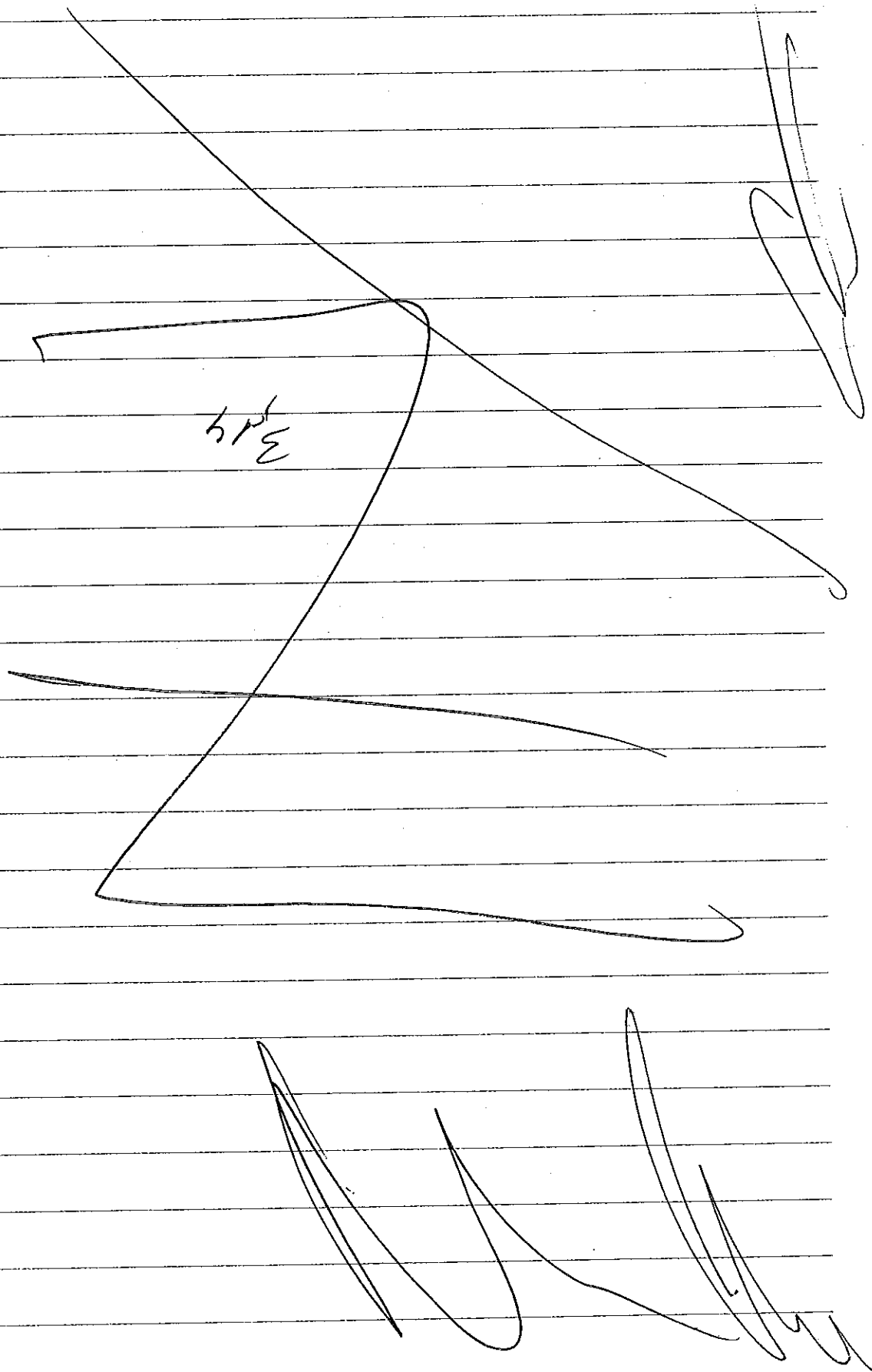
SW support
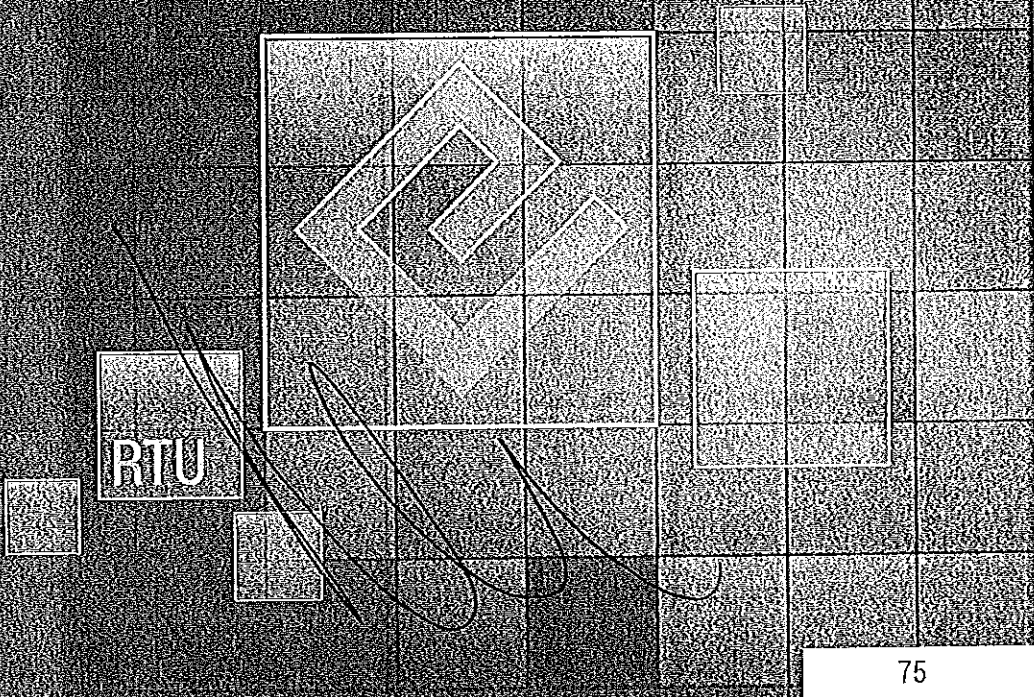
RTU Communication set

Brief characteristics

- ☑ Parametrization of RTUs and similar devices (redundant power supplies RPS II or diagnostic cards MPC),
- ☑ archiving of parameters in database or XML files,
- ☑ diagnostics of units and connected technologies,
- ☑ continuous indication of momentary status of units,
- ☑ recording of communication with units to file,
- ☑ control of units outputs,
- ☑ communication link between units and control and visualization system,
- ☑ recording of communication with control and visualization system to file,
- ☑ support of standards DDE and OPC, support of communication protocols IEC 60870-5-101 and IEC 60870-5-104,
- ☑ various system topologies,
- ☑ optional redundant use in hot backup mode.

Basic description

The RTU Communication set is a set of programs which enable the complete and comfortable operation of RTU units and similar equipment. By using these programs, it is possible to use the mentioned equipment to its full potential. The communication set consists of the following basic programs:

- ☑ RTU Communicator,
- ☑ RTU User center.

The RTU communicator ensures communication with the operated equipment or with the SCADA system and RTU. The User center provides the user of the Communication set with a comfortable graphic user interface. The Communication set includes the Microsoft SQL database server.

Communication scheme
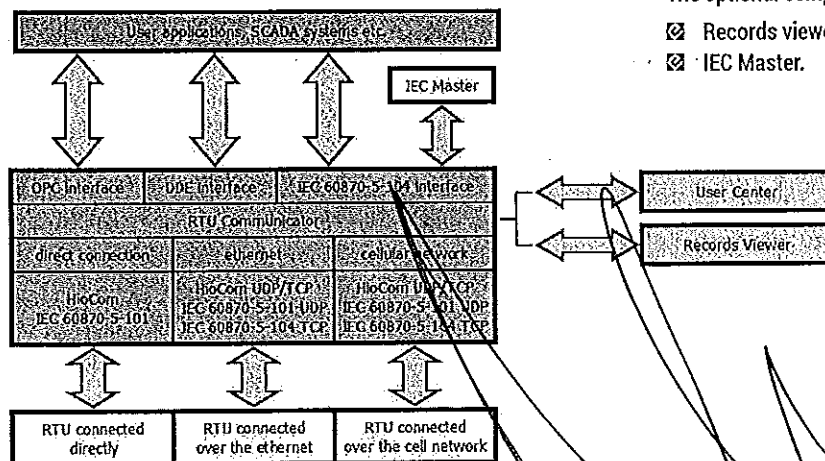
Topology of Communication set

The Communication set programs (including the SQL server) can be installed on one computer or each on separate computer or they can be arbitrarily combined on their host computers. It is also possible to use a multi-user installation where the Communicator and the SQL server are located on one or two central computers and the User center is installed on several client computers.

Redundancy

The RTU Communicator can be doubled and used with the redundant connection of such a pair. In this mode, the connection and communication with RTU units is maintained by one of the Communicators from the pair and the second fulfills the role of hot backup. In the case of the breakdown of the first communicator, the second communicator automatically takes over the communication. Depending on the MS SQL server used, the backup Communicator provides services for the User center.

If one MS SQL server in the Express edition is installed with each Communicator (standard Communication set), then in the case of the failure of the main Communicator, the backup Communicator only takes over communication functions, so it maintains the communication between the SCADA system and the units. It is not possible to connect to the backup Communicator through the User center.

However, if the user provides MS SQL server with guaranteed availability or selects the set with MS SQL server standard edition, the backup Communicator takes over all functions in the case of failure of the main Communicator, including the possibility of work in the User center.

Optional components

The optional component of the Communication set can be:

- ☑ Records viewer,
- ☑ IEC Master.

The Records viewer is a suitable accessory of basic programs if the function for recording of fault waveforms is used in the RTUs. The IEC Master serves for the diagnosis - during the verification of communication with the units or by RTU Communicator, it simulates the master SCADA system.

RTU Communicator

Brief characteristics

- ☑ Server for communication with the RTUs and similar equipment (redundant power supply RPS II or diagnostic cards MPC),
- ☑ communication gate or concentrator between the control and visualization system and the RTUs,
- ☑ communication with RTUs through the TCP/IP network by TCP and UDP communication protocols,
- ☑ communication with RTUs through the RS485 network and RS232 line,
- ☑ standards DDE and OPC, communication protocols IEC 60870-5-101 and IEC 60870-5-104,
- ☑ operation on the background as OS service,
- ☑ configuration in the database and/or in XML file,
- ☑ storage of records from RTUs into files,
- ☑ recording of values into daily files,
- ☑ recording of communication with units into the file,
- ☑ recording of communication with control and visualization system into the file,
- ☑ recording of fault and operating messages into the file,
- ☑ option of redundant application in hot backup mode.

Basic description

The RTU Communicator is a server for communication with remote terminal devices which use the communication protocol HioCom or HioCom2 (RTUs, RPS II, diagnostic cards MPC), communication protocol IEC 60870-5-101 or IEC 60870-5-104. It collects a data from the connected terminal devices and enables the control of these devices. It runs in the background of the operating system as its service. The actual status of the signals and measurements (only for these transmitted via protocols IEC 60870-5-101/104) can be browsed on the service web interface. The communicator itself does not have a user interface; it is implemented by the RTU User center. This pair of applications must be completed by the database server Microsoft SQL.

Communication on the line

The RTU Communicator, in addition to the standard implementation of the IEC 60870-5-101 protocol, has implemented a special optimizing algorithm for communication on the line. The line communication is optimized for the radio network with high latency where commands from the control station must be sent preferably before less critical data. During the command, the stated communication channel is reserved only for the control which ensures the shortest possible time for the execution of the command and gathering back information about the execution.

For communication on the line, it is not necessary to implement any additional configuration. The Communicator itself detects a way of communication with slave devices on the basis of the presence of one or more devices under one communication interface.

External data interfaces

The communicator can provide a collected data to other applications through its external data interfaces. The applications can also control terminal devices by means of these interfaces. The Communicator has three interfaces:

- ☑ DDE – interface uses DDE technology,
- ☑ OPC – the interface uses OPC technology. The interface is implemented through the DLL library which operates without the license only for the first 30 minutes after start of the Communicator. For full operation, the Communicator with OPC license must be purchased,
- ☑ IEC-104 – operates according to the standard IEC 60870-5-104, in the role of TCP server.

Implementation of the RTU Communicator

The most common implementation of the RTU Communicator is use as a part of the Communication set delivered to the RTUs (including the SQL server in the Express edition). In this implementation, the Communicator is used as a parametrizing tool, so external data interfaces are not used. The configuration of the parameterized units is stored in the database or in an XML file. No extended license is provided for the Communicator, at the stated moment it is possible to communicate only with one RTU. All Communication set programs are installed on one computer and the Communication set is a single user.

A further type of implementation is the independent concentrator or communication gate. The Communicator is used this way if there is demanded a mediator between RTUs and SCADA. It is presumed that the number of terminal units is static. Then it is possible to apply the Communicator independently without the User center and without the MS SQL server, to set it for using an XML file as a storage area for configurations of RTUs and to exploit some of its external interface. In this case, it is necessary to purchase the Communicator with the expanded license for the appropriate number of terminal units. To achieve the redundancy, the Communicator can be doubled.

If the mediator is required between the SCADA system and the RTUs but it is presumed that during the operation the system will be expanded or decreased or that the configuration of the units will be changed during the operation, it is recommended to apply the whole Communication set in the role of the concentrator or the communication gate. The Communicator is then installed on the central server and is set so that the storage of the configuration only uses the database. The SQL server is installed either on the same computer as the Communicator or on another central server. The User centers are installed on client computers. Such an implemented Communication set is multi-user and it is necessary to purchase the Communication set with the expanded license for the appropriate number of terminal units and for the appropriate number of the User centers installations. By doubling the Communicator, eventually also the MS SQL server, it is possible to achieve a redundant character of the operation in the hot backup mode (the detailed description is in the chapter about the RTU Communication set).

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RTU User center

Brief characteristics

- ☑ User interface for configuration of RTUs,
- ☑ data organization in tree structure,
- ☑ filtered displaying of tree structure,
- ☑ bulk operations,
- ☑ easy user scripts,
- ☑ multi-user mode, access control,
- ☑ possibility of connection of hundreds of units,
- ☑ storage of tree structure into XML file,
- ☑ data storage in SQL server.

Basic description

The RTU User center is a user add-on of the RTU Communicator and enables the complete and comfortable service of ELVAC RTUs and similar devices. It does not communicate with RTUs directly, but through the RTU Communicator. Both applications use the SQL database as a storage area of the whole data structure. All three programs are an integral part of the whole package with the name RTU Communication set and they communicate between each other through the Ethernet network.

The User center is designed so that it can run in the system in several installations, it means in multi-user work. Each User center in the system can only display an image of the status of the system (measurements and signals) - the off-line mode, or can display live data as it changes in real time - the on-line mode. The number of User center running at the stated moment in the on-line mode is restricted by the provided license. The license provided free of charge to any purchased ELVAC RTU enables only one on-line User center. However, it is always valid that one RTU can be configured at the same time only by one user, the other users only have access for reading.

All data concerning RTUs is arranged into the tree structure. At the lower layer are the communication channels used by RTUs for communication (RS-232, UDP / HioCom, TCP client / IEC 60870-5-104, etc.), then there are its own units or the slave units and then there are channels or sub-channels. Each node of this tree structure contains a set of parameters which describes its properties and also a set of the actual data which, after the connection to the unit, displays the status of the node. The display of this information can be configured according to the demands of the user. The optional display also includes the option of filtering and help for individual parameters.

The selected operations can be executed together for more terminal units or measuring, signaling or control channels. Some mass operations are directly integrated into the user interface, some must be implemented through simple user scripts.

The main goal of the application is the parameterization of units which represents setting the correct values of all parameters and then the transfer of these parameters through parametrizing files into the RTU. Everything is fully simplified. There is Help for parameter settings, displaying of data types, ranges of values and units, option for the mass change of parameters for more nodes and some functions for finding potential conflicts in the setting. The process for the parameters transfer into the unit is reduced only to the selection of this function and then there is a whole series of actions which remain hidden from the user although the results are logged into the information window.
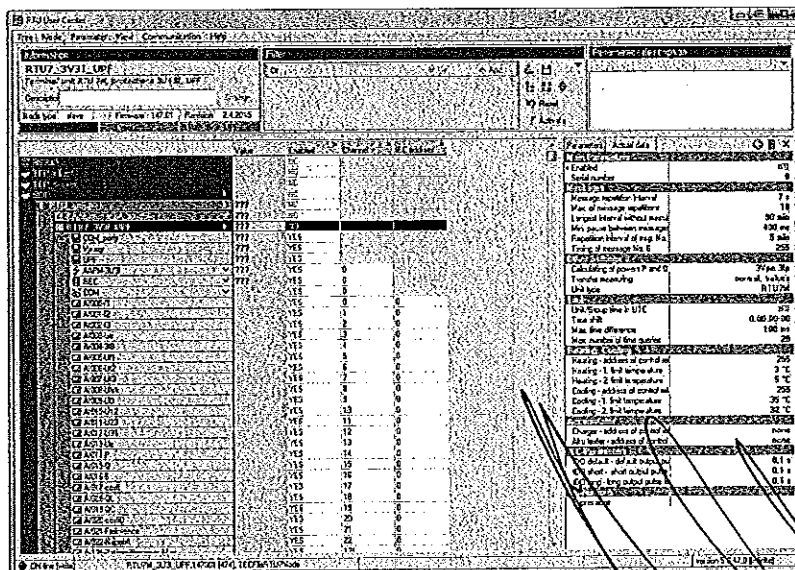
Records viewer

Brief characteristics

- ☑ Viewer of records from ELVAC RTUs,
- ☑ easy analysis of failures (short circuits, overcurrents, earth faults),
- ☑ analysis of the behavior of protections and signaling,
- ☑ automatic detection of the type of record (according to the type of unit),
- ☑ display of waveforms with the instantaneous voltage and current value,
- ☑ display of waveforms with effective voltage and current values,
- ☑ calculation and display of waveforms of instantaneous and effective values I_0, U_0,
- ☑ calculation and display of waveforms of instantaneous and effective values of harmonic I_0, U_0,
- ☑ display of phase diagrams,
- ☑ calculation and display of the time waveform of angle φ_0,
- ☑ change of the scale on the timeline, timestamps (real time),
- ☑ export of records (formats CSV and Comtrade),
- ☑ demo mode for testing.

Basic description

The Records viewer displays the time waveforms of the measured values, calculated values and flags of protections, indicators of fail currents and the automatics generated by the ELVAC RTU series.

This enables a fast analysis of failure states, such earth fault, short circuits and overcurrents. This SW can be used with an advantage during the verification of the correct function of the newly installed devices, e.g. for checking the phase sequence.

The main window of the application is divided into three parts:

- ☑ The first and second panel contain the waveforms of three-phase measurements of the voltages or currents (combination of 3V+3I, 6V, 6I according to the RTU configuration),
- ☑ in the third panel are timelines for individual protection flags, the reasons for running the records.

In the first two panels is possible to display the waveforms of instantaneous values of three-phase measurements of the voltages or currents. The values can also be displayed in the form of phasor diagrams.

In addition, it is possible to switch display into the mode with timeline of the effective values of three-phase measurements. Instantaneous and effective values I_0 and U_0 and the first harmonic I_0 and U_0 are calculated. There can also be displayed timeline of the angle φ_0, which is also calculated.

The displaying of individual waveforms can be enabled or disabled using the check boxes next to both panels. In this area, all the values are displayed depending on the position of the cursor in the graphs.

Third panel shows the protection flags, flags for signaling of the protection activation, status of the power element etc. It is possible to detect the reason of running the record and the protection activation. The meaning of each flag is displayed using the tooltip.

In ELVAC RTU series, the waveforms are recorded typically 100 ms before the trigger event. The trigger event is displayed on all three panels. The records also include the timestamps (real time). On the timeline, it is possible to change the scale and it is possible to scroll fluently through the records.

The Records viewer enables to export data in several formats for use in further applications - with respect to the option of analysis of the records from ELVAC RTUs in third parties SW, where the Comtrade format is especially important.

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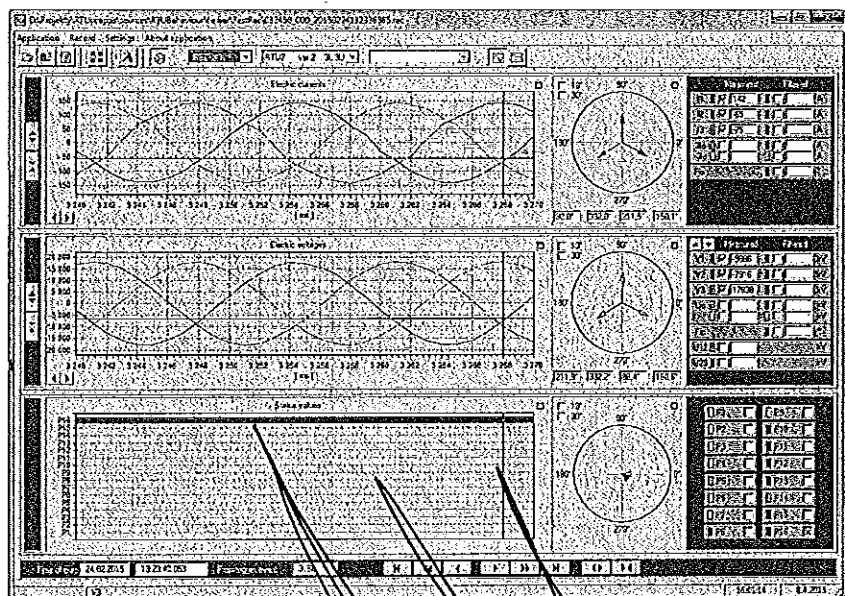
IEC Master

Brief characteristics

- ☑ Communicates through protocols IEC 60870-5-101 and IEC 60870-5-104,
- ☑ data transfer through serial line, TCP (client and server) and UDP,
- ☑ displaying of actual signal states and measurement values,
- ☑ generating of general query, time synchronization, commands,
- ☑ ongoing communication recording and storage,
- ☑ statistics displaying,
- ☑ easy configuration of application,
- ☑ possibility of storage and uploading of configuration,
- ☑ demo mode for tests.

Basic description

The IEC Master primarily serves for testing and verifying the slave devices which communicate through IEC 60870-5-101 and IEC 60870-5-104 protocols. For the data transfer, it is possible to use serial line, TCP protocols (client and server) and UDP. In the configuration of the application, it is sufficient to set only several communication parameters and the application is ready for the use. The database of signals and measurements is created dynamically, it is not necessary to define it in advance. The application provides the states of the signals and the values of measurements (standardized values and decimal numbers), including quality attributes. It is possible to send a general query to the slave device, time synchronization, testing command, single-bit and double-bit command with or without the timestamp. For diagnostic purposes, the list of the ongoing communication is displayed. For automatic testing of the application, there is the interface for running of the test scripts.

Communication log

The ongoing communication can be logged. The user can select the level of logging. At the first level, clean data is logged which is sent/comes into/from the selected communication interface. At the second level, transferred data is processed at the level of the connecting/transport layer (establishment and maintenance of the connection, ...). The third level logs the application data (values of signals, measurements ...). It is possible to save the communication log for further analysis at the request of the user, or automatically.

Testing interface

The IEC Master automatically tests the inputs and outputs of the slave device. It is possible to define the scenario with the events (output control) and the responses to them (requested signal states). In addition, there is defined the time limit (the response must occur within the predefined time). The output of the test is the report which contains the list of changes occurred on the monitored device, including information of whether this change was or was not expected. After termination of the test, there is displayed the statistics of faulty (unexpected) signal states. The incoming measurement only evokes a warning.
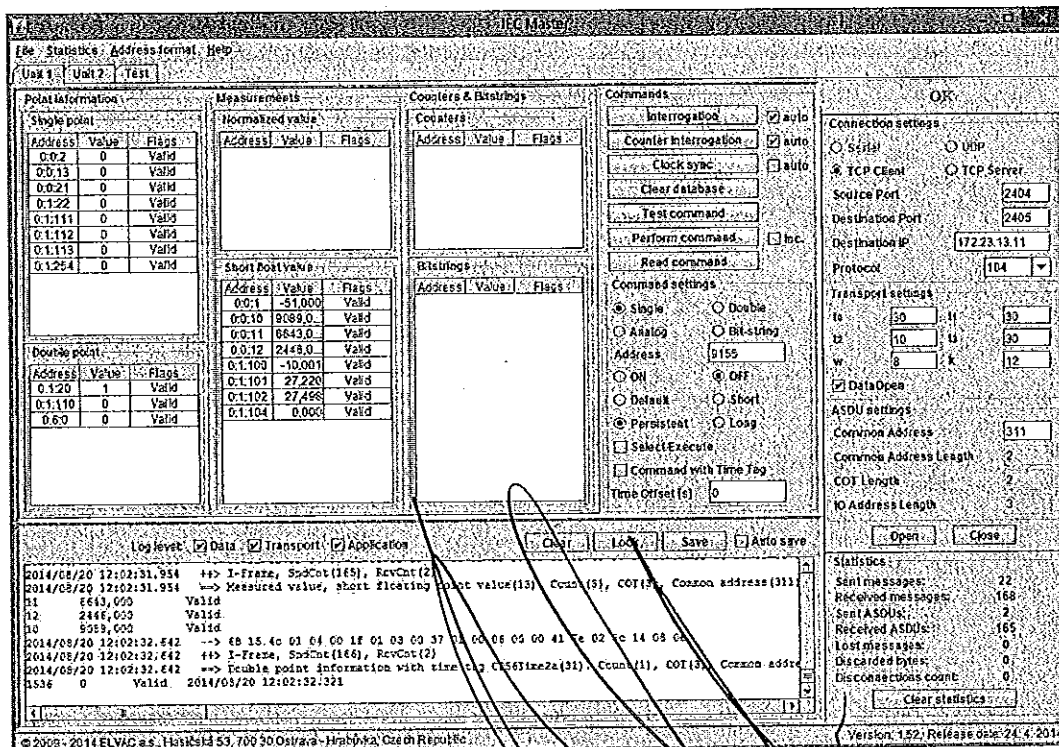
SCADA SW Mikrodispečink

RTU

SCADA SW Mikrodispečink

General description

Mikrodispečink is a specialized SCADA system for the monitoring, control and evaluation of processes in real time which is particularly recommended for the control of electrical networks with high, medium and low voltage, for applications in power stations and in control centers. The system enables the safe and effective control of technology from the control center, integrates control systems in power stations and networks into one unit, and provides actual images of the controlled technology, historical data and eventually the predicted data. It creates a support for the preparation, operative control and the consequent evaluation of the operational processes.

This product has been successfully used for many years in control center and substations not only in the Czech Republic, but also abroad and is regularly improved and developed.

Mikrodispečink can be operated on servers and client stations with OS MS Windows, for data storage there can be used a cluster solutions working with other operating systems (Unix, Linux). Standard HW and SW is used, no special HW and SW is required. The creation and maintenance of SW SCADA Mikrodispečink is usually implemented in the Borland Delphi development environment. The Mikrodispečink control system is designed with maximum modularity and an open character. The basic interface for data access is at the level of DLL, COM/DCOM, UDP/IP and TCP/IP.

The configuration of the real control system is created by writing the data into configuration tables and drawing diagrams in the graphic editor. Important attributes of the system are reliability, easy applicability, preparation for connection with systems from other suppliers, effective maintenance and focus on the user. The system is designed on a modular principle, is sufficiently adaptable, expandable and enables problem-free interconnection with further systems. It ensures maximum accessibility of data from the individual integrated monitoring and control systems.

The control systems for power stations and control center are integrated into LAN and WAN SCADA. The system in the control center is designed in a standard manner with certain HW redundancy. This redundancy ensures, in the case of a breakdown of one or more elements, the access of functions and data and the minimal or no restriction for users. Remote service and user access is possible in the system, including access through the intranet (Internet). The system enables the backup, including control from another workplace or from another locality. It enables the operative change of the scope of the area controlled from each workplace. The

uniform central model of the whole controlled electricity network is important for ensuring the effective and safe system administration, individual data and outputs for users. In one control system, there is an actual telemetric, eventually manually inserted image of all controlled networks of high, medium and low voltage. Maximum access to data from individual integrated control systems is ensured. In the case of non-accessibility of the master system, usually in the control center, the work is done by local data copy. In this time, the restriction is only in the fact that in subordinated systems it is not possible to create and edit shared data; the telemetric data remains actual.

During the resolution of the communication with other systems, standard input/output communication interfaces are used. Mikrodispečink can also run as a mediator between various mutually incompatible systems that cannot be directly connected. It can also be operated as a data concentrator and as a simple or network communication server. Various types of communications are used, point to point and point to multipoint, including communication through GSM CSD and GPRS (according to available mobile network generation in the stated region). Mikrodispečink has the implemented support of communication TG 800 Master and Slave (point to point, transit, line emulation), IEC 870-5-x, MDXL including network version, MCS, CVM Modbus, DMS, DO100, SAIA S-Bus and others, with the RTU Communicator there is available also protocol IEC 61850. Great attention is focused on data security, particularly during the control when the blocking conditions can be also evaluated. In the case of a request for the connection of Mikrodispečink to another system, some of the currently directly supported serial communications, including network, COM/DCOM interfaces can be used, eventually a further type of interface or communication can be included into the system.
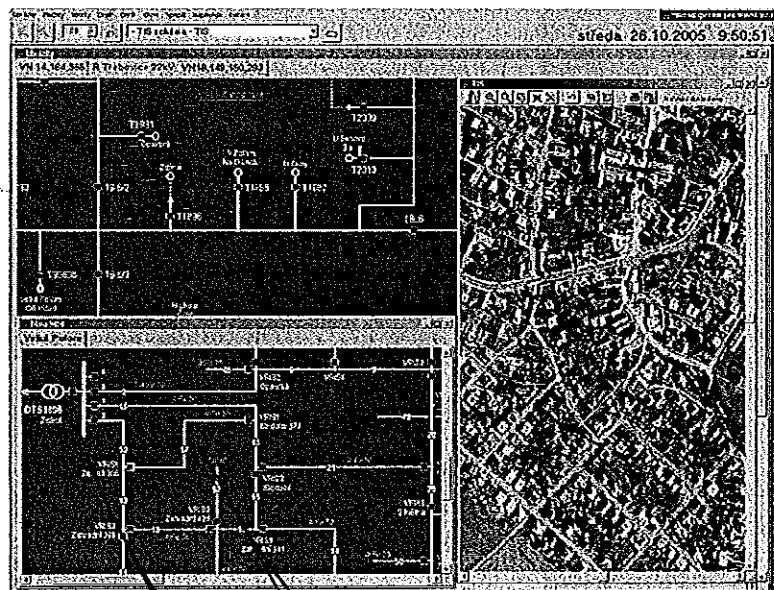
Brief list of features

☑ **Images** – diagrams of electric stations and networks with the actual statuses and values of measurement, with the option to place marks and comments, with control, with possible change of the scale of display and switching into further diagrams.

☑ **Diary** – protocol with changes and alarm messages with wide options of the filtration for the displaying, confirmation of changes, insertion of comments, consequent processing of archived data.

☑ **DispP** – the module automatically evaluates the actual and planned values of loading, supports trade dispatching control in real time.

☑ **Sheets** – actual and archive summaries of measurements of hourly sections, maximal, minimal and mean values of loading, including archiving and possible consequent off-line processing.

☑ **Samples** – module for sampling and archiving of all changes of measurement values, with on-line and off-line processing of the values in graphs.

☑ **Change calculations** – this function enables to perform effective, fast and secure generation and maintenance of the control system and automatic outputs for displaying, supports the transparency of the system from the viewpoint of the user during the accumulation of changes.

☑ **Simulation of connection** – the user can set the required configuration (model) of the network with the consequent automatic recalculation of the topology and evaluation (colouring) of the network parts and consumers without voltage (for ex. during a downtime).

☑ **Colouring of diagrams** – according to various criteria it is possible to colour the diagrams of the electric stations and networks, e.g. according to sources, i.e. with the indication of the connection to the defined supply node, etc.

☑ **Sending of SMS and e-mails** – using GSM and Intranet it is possible to automatically send information about changes of specified signals or user-typed text messages.

☑ **Access through WEB** – the pages use the advantages of web technologies. Necessary components are downloaded automatically to the user's PC. The access to SCADA data is possible through the intranet (Internet), including the option of mobile access through GSM.

☑ **Displaying of information from TIS/GIS/CIS** (orthofotomap, clients, ...) to the selected object in the control system (to DTS, line section, ...).
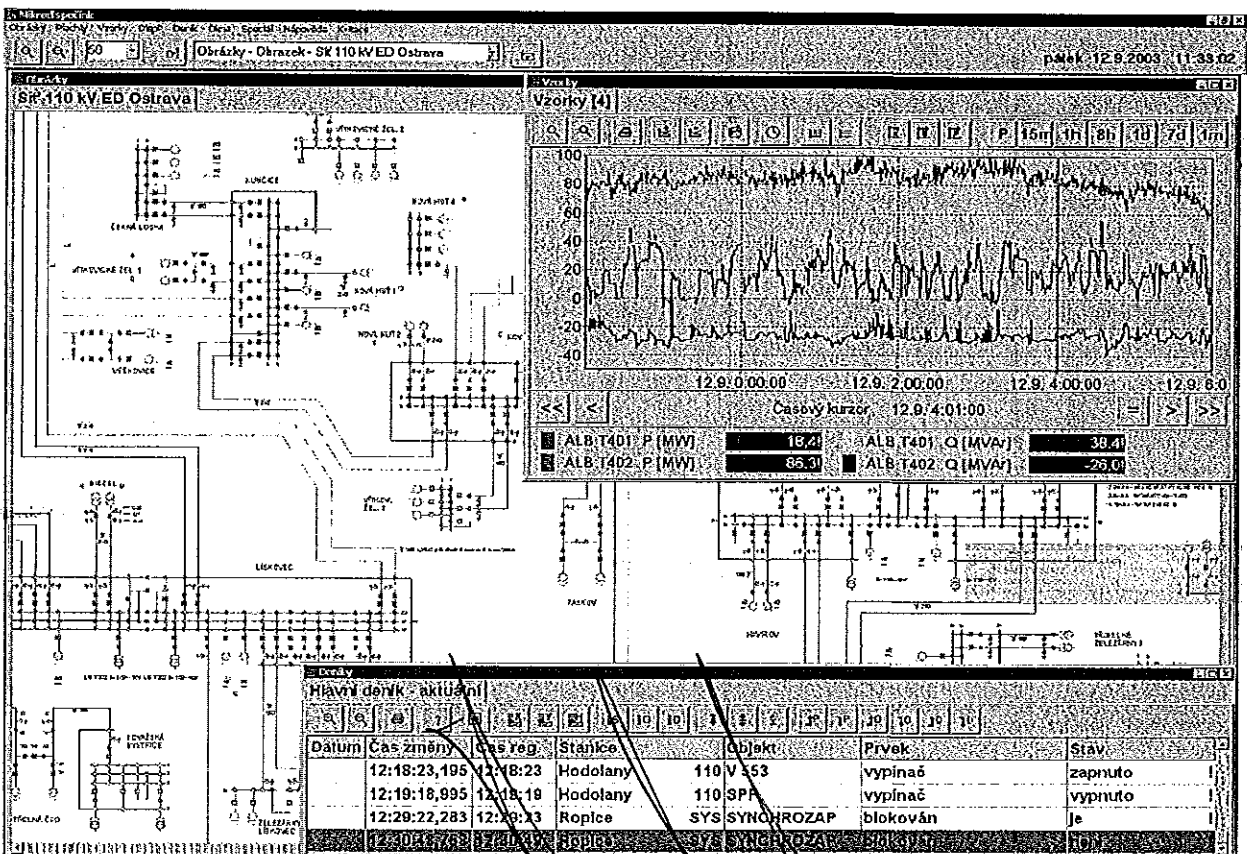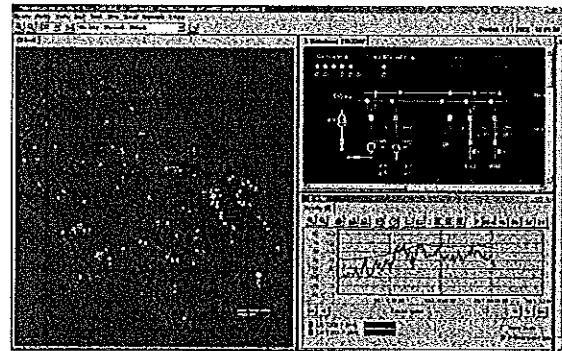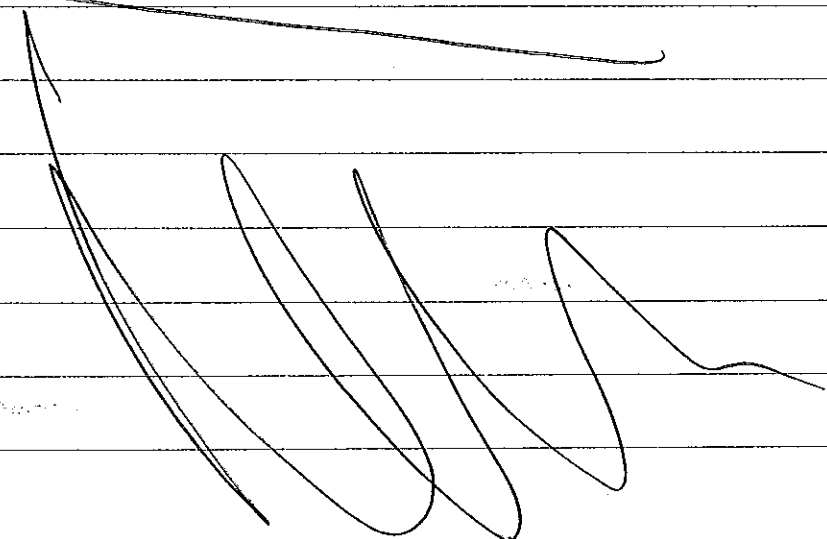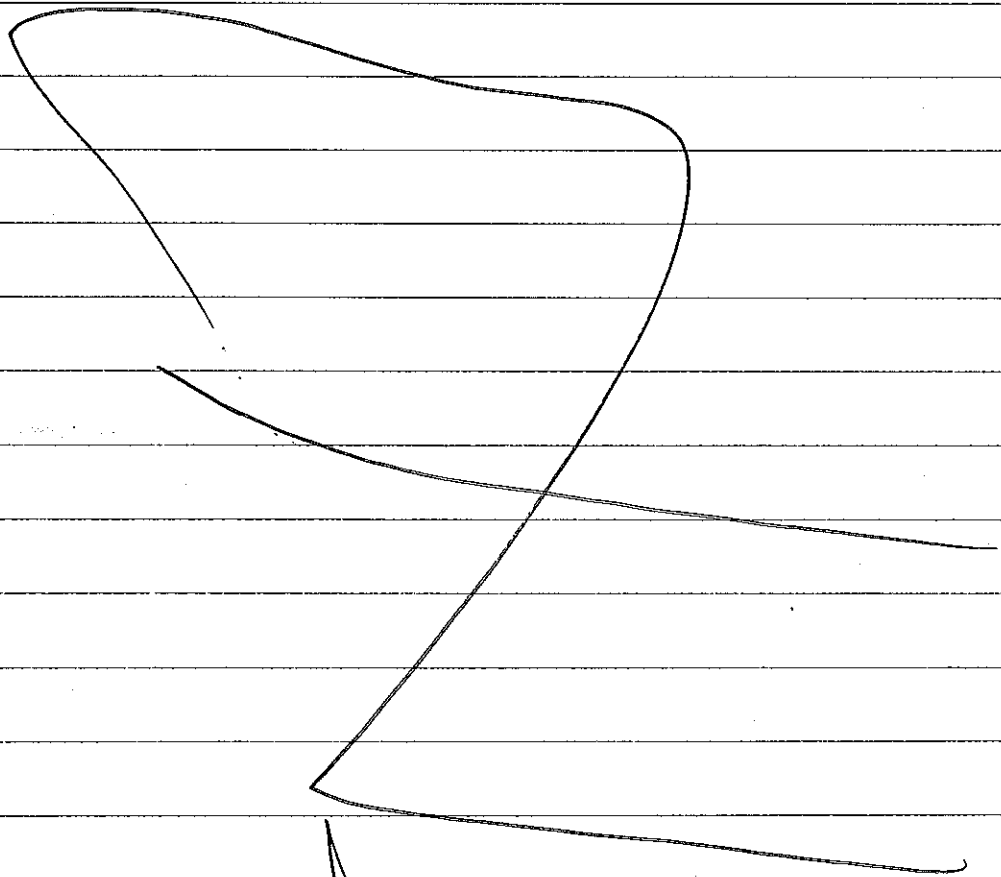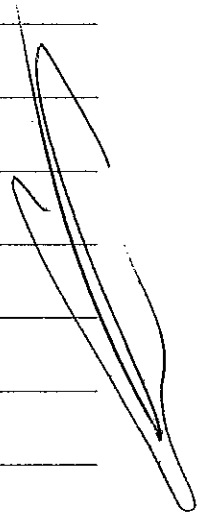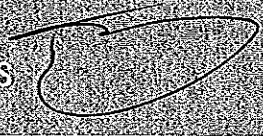
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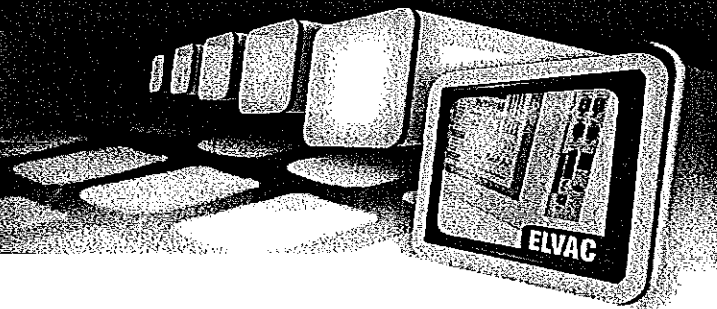
SIG-D-EXTxx – сигнален модул, външен

xx- показва захранващото напрежение05 = 5V,12 = 12V a 24 = 24V напр. батерия

5.15.3 Техническа спецификация на модулите

Модул	SIG-D	SIG-D-EXT05	SIG-D-EXT12	SIG-D-EXT24
Брой на LED диодите	10 LED (9 бр. диаметър 5mm, червени и 1 бр. диаметър 10mm, двуцветни -червен-жълт)			
Интерфейс за връзка с RTU устройството	Вътрешна шина	RS-485		
Захранващо напрежение	Захранване от вътрешната шина	5VDC	9-18VDC(max.3W)	18-36VDC(max.3W)
Потребление	1W			
Конектор	-	1 x WAGO 231-304/026-000, част от доставката; 0,08-2,5mm2		
Температурен диапазон	-20℃ до +55℃			
Температура на съхранение	-30℃ до +75℃			
Околна относителна влажност	30% - 95%RH некондензираща			
Покритие	IP20			
Позиция в 5/8-10/16 слотова шина	Не може да се оборудва / 1/ не може да се оборудва	Поставена външно, не заема позиция в шината		

Табл. 65 – Сигнални модули

5.15.4 Описание на конекторите

Пин	Описание
+, -	Захранващо напрежение
A, B	Сигнали за връзка от линия RS-485

Табл. - 66 Описание на конекторите SIG-D-EXTxx

Рис. 64 - SIG-D-EXTxx конектор

5.16 СИГНАЛНИ МОДУЛИ ЗА МОНТАЖ В ТАБЛО

5.16.1 Общо описание

Тези модули за сигнализация са предназначени за монтаж в табло, максимална дебелина 5,5 мм.

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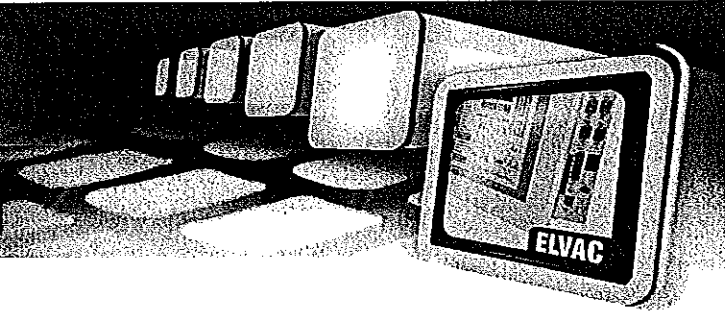
Първият представител на тези модули е ESP7 . Той е оборудван с 22 LED диода, чиято функционалност може да се конфигурира с помощта на стандартен софтуер за параметризиране, предоставян към RTU устройствата (RTU Потребители център). Параметризирането се осъществява в едитора изображения. FW на RTU единиците трябва да бъде 105.02 или по-висок . Функцията на всеки LED може да се определи на базата на вътрешни състояния на RTU единиците (дигитални   входове, дигитални   изходи, аналогови входове, виртуални аналогови и дигитални входове, вътрешни състояния и др.) За всеки LED може да се настрои да свети постоянно или да е изгаснало, с бързо или бавно мигане, със забавяне на реакции и т.н. Описанието на функциите на LED диода на предния панел може да се променя от потребителя.

Сигналният модул се захранва с напрежение, което е на разположение на конектора на комуникационен интерфейс RS - 485 на устройството RTU. По този начин не е необходимо да се осигурява резервно захранване за сигналния панел. Свързването е направено с прав кабел с краища RJ45 . Панелът може да бъде свързан към всички единици тип RTU7M , RTU7K , RTU7.4 , които са оборудвани с комуникационен интерфейс RS - 485.

5.16.2   Означение на модулите

ESP7 – сигнален модул с 22 LED индикатори

5.16.3   Техническа спецификация на модулите

Модул	ESP7
Брой на LED диодите	22 LED (диаметър 3mm, зелен)
Интерфейс за връзка с RTU устройство	RS-485
Захранващо напрежение	5VDC
Потребление	Max. 1W
Конектор	RJ45
Размери	144 x 144x 71mm (š x v x h)
Размер на отвора за вграждане	138 x 138mm
Минимална дебелина на панела за вграждане	Max. 5,5mm
Дълбочина на вграждане	64mm (без конекторите)
Температурен диапазон	-20℃ до +55℃
Температура за съхранение	-30℃ до +75℃
Околна относителна влажност	30% - 95%RH некондензираща
Покритие	IP20 (избирателно IP54)

Табл. 67 – Сигнални модули за монтаж в табло

5.16.4 Описание на конектора

Рис. 65 - Конектор RJ45 интерфейс RS-485
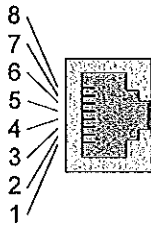
Пин	COM-485
1	GND
2	GND
3	GND
4	NC
5	B (DATA+)
6	A (DATA-)
7	+5V
8	+5V

Табл. 68 – Свързване на конектора RJ-45

Рис. 66 – ESP7 с размери

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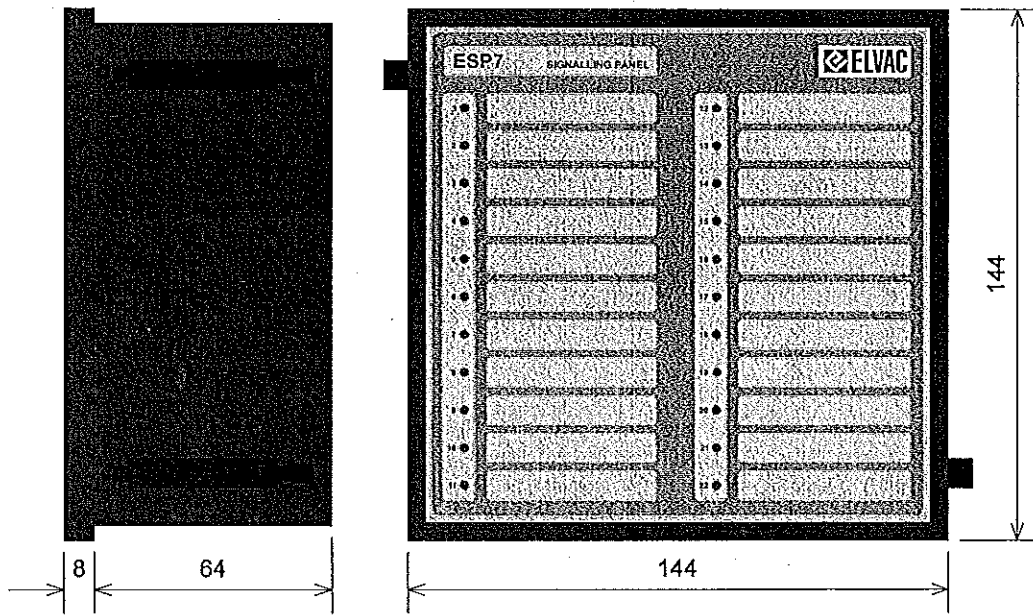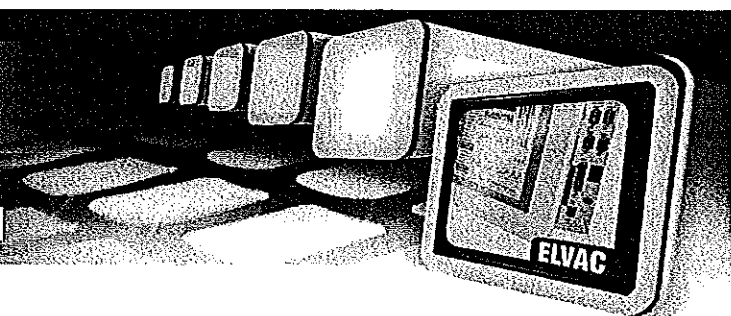
6 Как да постъпваме при проблеми

Когато устройството работи нестандартно или изобразява съобщение за грешка, Ви молим да обърнете внимание. Може да става въпрос за малък проблем, който можете да решите сами, но могат да се появят признаци на важен проблем. Ако изключите основните възможни грешки на обслужването (напр. невключен кабел, повреди в някои от перифериите и т.н.) и проблемите продължават, доверете се на специалистите. Можете да ни търсите на сервизната линия, ще Ви помогнем с радост или ще уговорим посещение на място, при Вас.

Вярваме обаче, че такива проблеми ще има малко, благодарение на нашата грижа, посветена на качеството на производството.

Молим Ви да обърнете внимание на приложенията с протоколите от тестовете, на Главата с гаранционните условия, а също и на частта за сервизна документация.

От името на целия колектив на ELVAC АД Ви благодарим за вниманието и се надяваме, че ще бъдете удовлетворени от нашият продукт.

КАТАЛОГ ELVAC
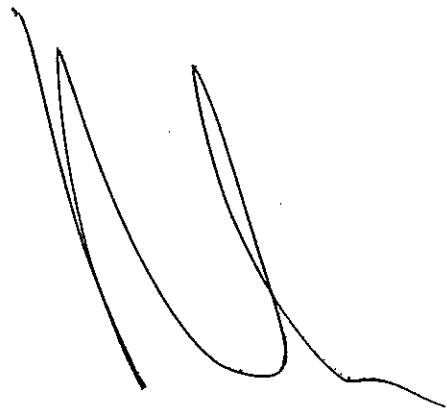
ELVAC
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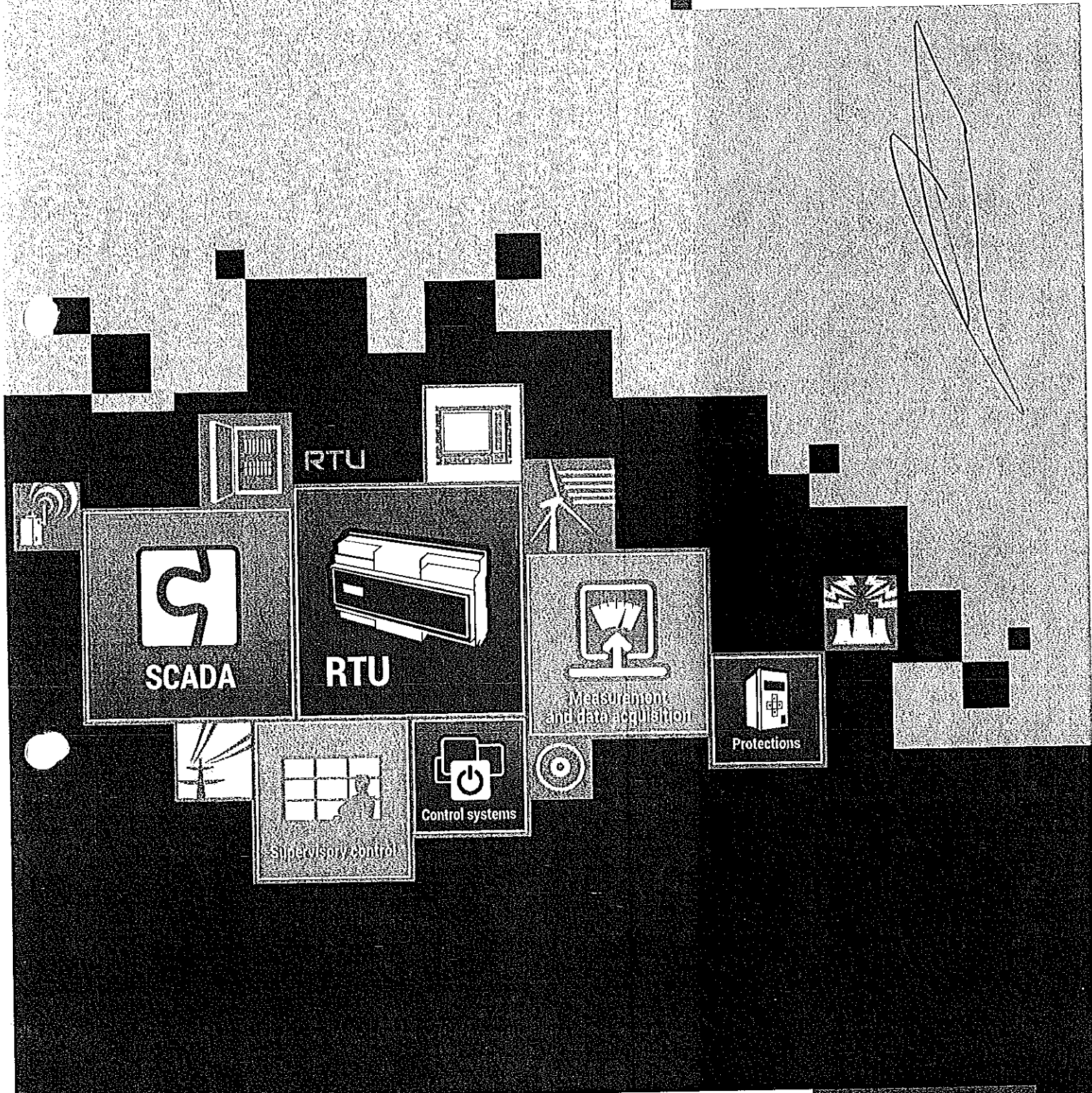
SCADA
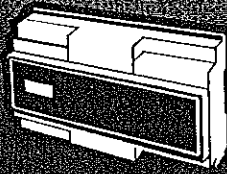
RTU
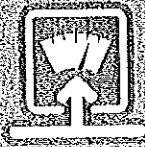
Measurement and data acquisition

Protections

Supervisory control

Control systems

Products for power industry **Catalogue**

Content

RTUs for control, protection, data acquisition and communication

RTU
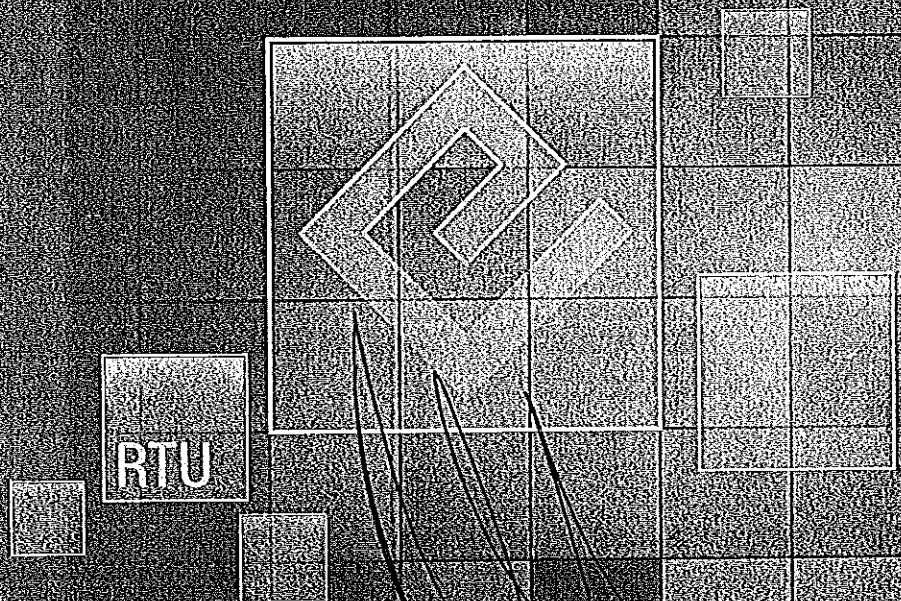
Basic information about ELVAC RTU products
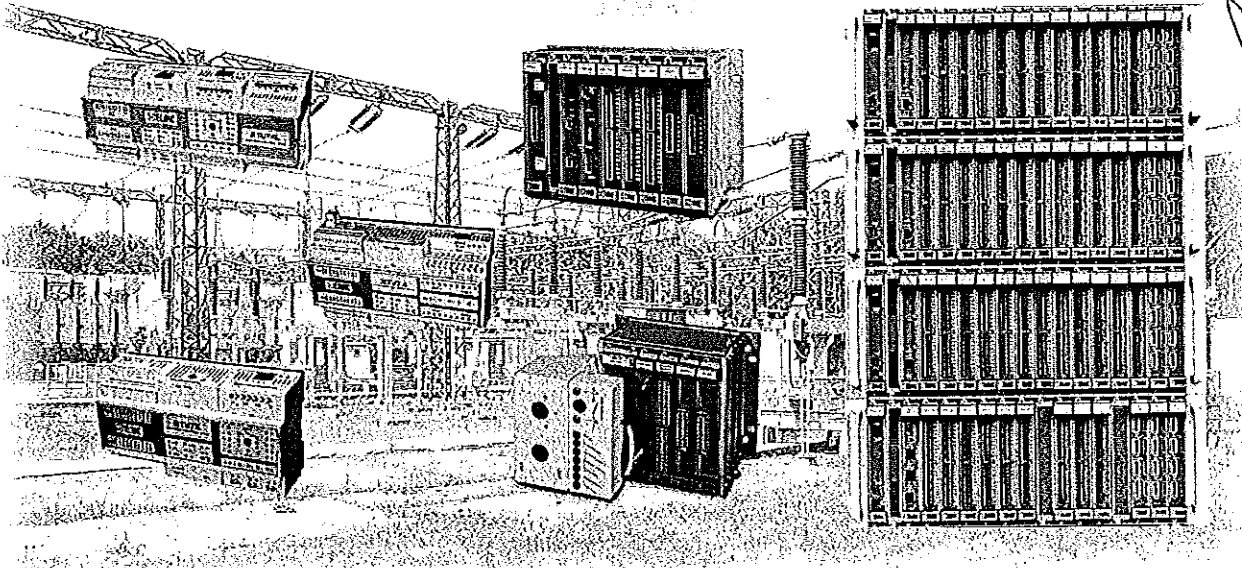
ELVAC RTU units are developed and produced directly in ELVAC a.s. and their features are a result of the knowledge and experience gained since the 1990s. Thanks to long-term cooperation with experts and perception of user needs we created devices that meet the highest demands of the energy field. Our own development and production mean a full product control to ensure the top quality based on top quality of components and manufacturing processes and we can provide also the highest standard of technical support along with customization and rapid response to market demands. The results of our work are the satisfied users of the many thousands of installations in the Czech Republic, but also in many other countries.

ELVAC RTUs include the following functions:

- ☑ control processor unit,
- ☑ wired and wireless communication interfaces with many communication protocols,
- ☑ digital inputs and outputs,
- ☑ analog inputs for measuring of current and voltage in three-phase systems and calculation of derived values,
- ☑ protection and automation functions for reclosing,
- ☑ programmable logic and relational functions,
- ☑ power supply with controlled backup battery recharging and battery status indication,
- ☑ temperature sensors, there can be connected the others, e.g. wind power or exposure measurement.

Internal architecture

Over years of development, simple units with digital inputs and outputs and a communication module have been replaced by unique devices that integrate many other devices typically used in energy sector. It simplifies installation, eliminates the trouble of connection and compatibility, increases reliability and user comfort. This all brings also cost effective complete solution.

Hasičská 53, 700 30 Ostrava - Hrabůvka, Czech Republic
Tel.: +420 597 407 323, Fax: +420 597 407 102, www.rtu.cz   ELVAC a.s.
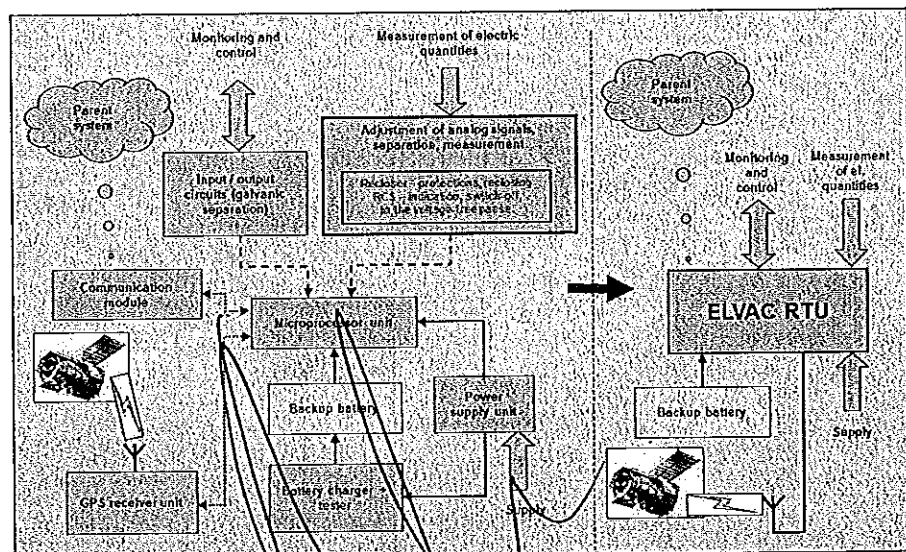
Compact and modular conception

In principle, ELVAC RTU products are divided into two basic groups: Compact and modular RTU. From the user's perspective, they are fully compatible with the same software basis. The differences mainly concern the hardware capabilities of the various types and the resulting installation issues.

Compact RTU features

☑ the entire unit is fitted in plastic box for mounting on DIN rail,
☑ the number of digital and analogue inputs is firmly defined according to the type of compact version,
☑ the internal design has partially modular character, there can be selected for ex. the communication interfaces or parameters of analogue inputs,
☑ it is used an external power supply from 10V DC to 40V DC,
☑ the expansion is possible via the RS-485 or Ethernet.

Compact RTU advantage

☑ if the number of inputs and outputs of the compact unit is sufficient, it is cheaper solution.
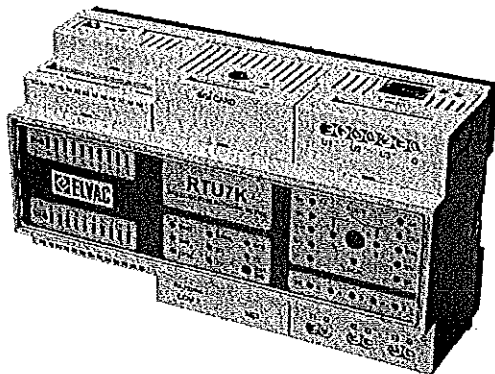
Modular RTU features

☑ optional chassis from 2 up to 16 slots for wall, panel or DIN rail mounting,
☑ the internal conception is fully modular, the system can be fitted according to the needs of the customer with the option of future expansion,
☑ there are available several types of power supply modules, which have an internal measurement of power input,
☑ the internal conception enables the use of direct and indirect cards. The basic difference is that the signal on direct cards is connected directly to the main processor of the unit, which means that they are very fast; however, the amount of these cards in the system is limited by the given number of CPU inputs. On the contrary, indirect cards are fitted with their own

control processor and communicate with the system through an internal serial bus. This communication is slightly slower, although as a result, more of these cards can be installed into the system and this is only limited by the performance of the power supply or the space in the chassis. In case of using the protective functions evaluated by the processor that is directly located on the bus for the connection of I/O signals, then direct cards are used, indirect cards are recommended for the expansion of inputs and outputs for large systems. Some types of indirect cards with their own CPU can work as a multi-channel failure indicator or complete protection - it is possible to operate several protections for separate outlets in one RTU chassis.

Modular RTU advantages

☑ "all-in-one" solution = all necessary modules in one chassis,
☑ unlimited configuration options,
☑ due to the internal power supply, there is wide range of supply voltages (e.g. directly from the power lines via the transformer),
☑ by measuring of the supply input, it is possible to evaluate the status on the side of power lines, where the power supply transformer is mounted (another measured information for users),
☑ modules for special sensors are available (e.g. wind, exposure, temperature).
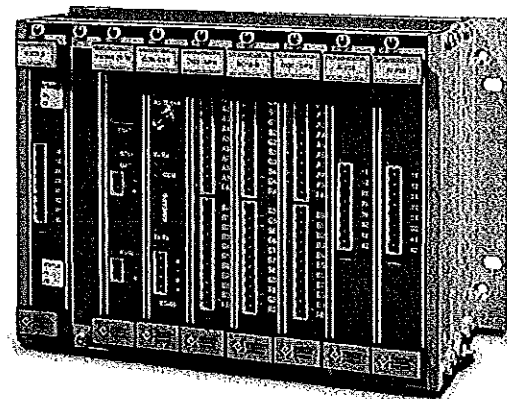
Control processor unit

The CPU board is equipped with reliable single-chip microcontroller, providing sufficient performance with low power consumption. For maximum safety of control, the switching of output relays is controlled by an auxiliary processor and the action occurs only when both CPUs are in accordance. The system provides the evaluation of each input quantity, calculation of derived quantities, recording of samples and signal filtering based on the defined limits.

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Communication unit

Communication options are wide. Units can be connected by wire and wirelessly with many types of protocols used in the energy industry. The user can do the remote device diagnostics, firmware update, remote parameterization, data reading, downloading records of measurements, etc.

There are available these communication interfaces: Ethernet, GPRS/UMTS, RS-232, RS-485, CLO, BT, proprietary optical RS-485 with the option of redundant ring communication with zero delay communication after the interruption of circle.

According to the used interface and the type of device there are available the following communication protocols: IEC 60870-5-101, IEC 60870-5-103, IEC 60870-5-104, IEC 61850, DNP3, MODBUS, HioCom2.

Units fitted with a communication card with built-in PC provide various options to secure the communication. As a standard it is supported the security by means of TLS (Transport Layer Security). TLS can also be used for configuration in the web interface (access via HTTPS), as well as for the communication via protocols IEC 60870-5-104 and DNP3 (generally for any protocol on TCP). Security is fully in accordance with the standard IEC TS 62351-3. Communication through IPSEC can be activated at the request of the client.

Digital inputs and outputs

Active (internal excitation voltage) or passive (external excitation voltage) digital inputs can be used in ELVAC RTU units. The excitation voltage can be selected from 9 to 300V. The digital outputs are implemented using either a relay with NO (normally open) contact or changeover contact. The number and variations of the digital inputs and outputs are given in modular configurations according to the type of card, for the compact version is the number firmly defined.

Analog inputs

ELVAC RTUs can be equipped with analogue cards for measuring of currents and voltages in three-phase system. Current inputs are optional for AC or DC ranges 5 mA, 20 mA, 1 A and 5 A. Voltage inputs are available in ranges from 2V to 400V. Overloadability and galvanic isolation of analog inputs are defined by the type of card and the parameters can be found on product pages of this catalogue. ELVAC RTUs can calculate further data based on the measured data, e.g. P, Q, S, phase shifts, frequency, U_0, I_0 or line-to-line voltage. Some cards can measure also U_0 and I_0, what is useful for higher sensitivity of protection functions.

## Programmable logic and relational expressions

With this feature it can be defined a new functionality in our RTU without modification of the firmware. The input values in the expressions can be measured quantity, signal or constant. RTU behavior can thus be adjusted by the user to suit the given application.

Protections and automation functions

Very interesting feature of ELVAC RTU are a protective functions which can so successfully replace the much more expensive devices in many applications. It is one of the important features that are built into our units and greatly simplify the installation of a complete application. According to the configuration of RTU, there are used the following protections:

☑ voltage protection,
☑ directional time-depending overcurrent and short circuit protection,
☑ current and voltage asymmetry,
☑ earth-fault directional protection,
☑ frequency protection.

Based on the evaluation of these protective functions, the user can use the automation functions, such as reclosing and disconnecting during non-voltage interval. According to the RTU configuration, there are available more blocks of protective functions.
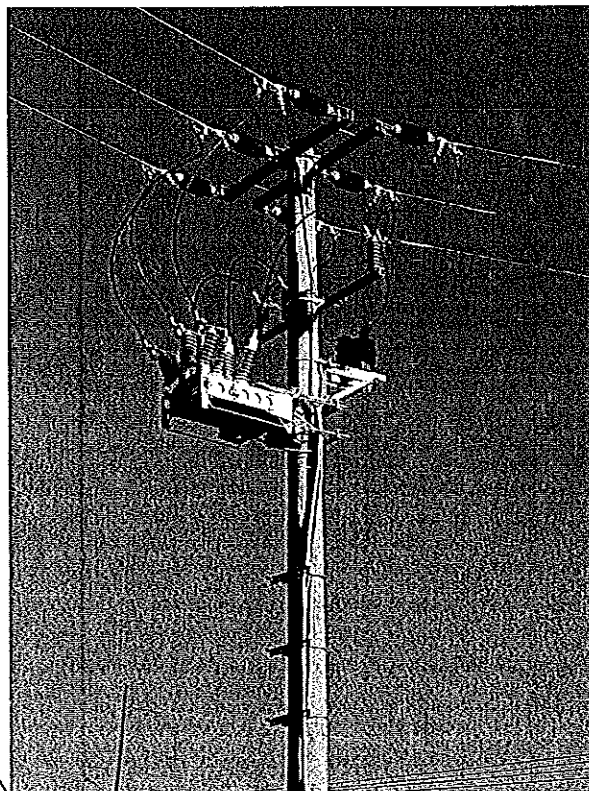
Waveform recording

Standard part of ELVAC RTU is the option to record the waveforms of measured currents and voltages and signal states. The recordings can be used for example for analysis of failures on lines. The recordings are stored in proprietary format or in COMTRADE format with period 1 ms.

Archiving

For slow speed recording of changes in measurements and signal states, there can be used a function of archiving. It is possible to use it for recording of values in different applications in utilities. The archiving is also used for measuring of power consumption. The advantage of archives is big memory capacity sufficient for long term records, depending on type of application.

Power supply with battery backup

Compact versions of RTU are supplied by voltage from 10 to 40V DC. External sources are used for the supply from other ranges. For modular versions, a wider range of sources with the supply voltage from 12V up to 360V DC or from 50V to 260V AC can be selected. ELVAC RTU checks the power supply input and in the case of outage, it is switched to the battery backup. The advantage of the modular version is that it can be directly connected to the AC source to provide the user with direct information about the status of the power lines, where it is connected. It is further measured information for users.

The modular and compact versions include an integrated battery charger and regularly inspects the capacity of the battery and also have an integrated function for battery protection against excessive discharging. If necessary, i.e. for backup of motor drives of switching elements, the configuration can also be strengthened for greater charging currents for higher battery capacities.

Expandability

Due to the wide range of communication capabilities, our RTUs can be used as separate units or in larger systems. Depending on the demands of the stated application, the system can be expanded by Ethernet communication or by the serial bus RS-485. This effective form of communication enables the RTU to be used as data concentrator, to which the other RTUs or the further external devices are subordinated. From the viewpoint of the application, everything looks like one unit.

Further options

Temperature sensors are available for checking of the environment in which the ELVAC RTU units operate. In this way, RTU itself can control the heating or cooling of the switchboard cabinet. Certainly there can be connected further sensors, for example for wind power or to measure the exposure, used in applications with renewable energy sources.

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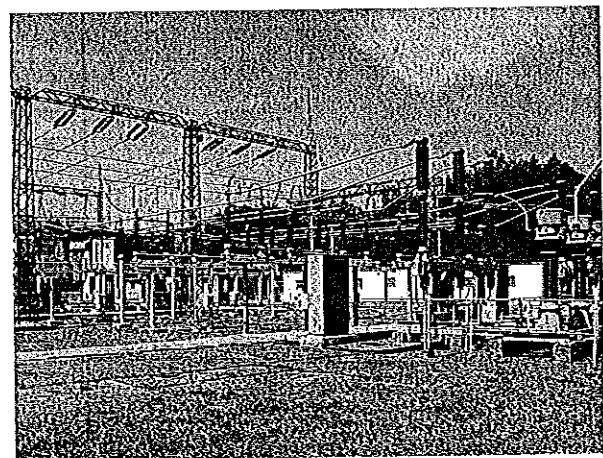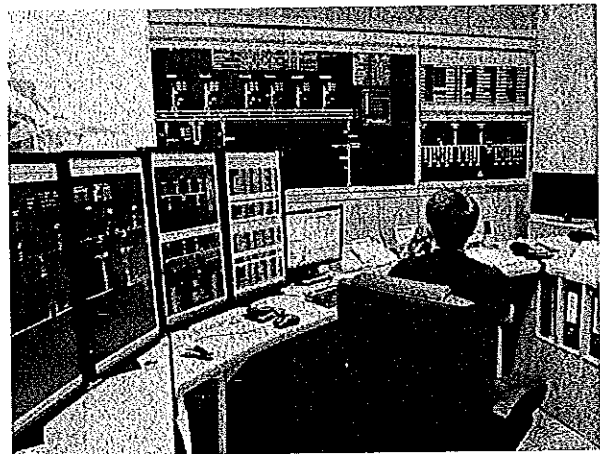
Typical ELVAC RTU applications

The general technical parameters of the units enable use in any area regarding the monitoring, processing and data acquisition. But in selected areas, the ELVAC RTUs with their specific properties significantly surpass the utility value of the third party standard units used for remote control.

A key area is the energy sector and its related industries where due to the direct three-phase measurement of voltage, current and the derived values in relation to the integrated protections and automation functions, the "all-in-one" solution for monitoring and control of distribution networks is offered. A galvanic isolation with high electric strength, digital inputs with impulse counter, period measurement and time filtering, enables easy and fast connection to consumption measuring devices (electricity meters, flow meters) in the electricity, thermal, gas, water sectors, etc. Great communication abilities, integrated temperature measurement, backup of power supply and other standard ELVAC RTU properties enable the use in a wide range of applications across the industry, transport and building automation.

The growing demand for intelligent networks (SMART GRID) in relation to the growing ratio of renewable energy sources, calls up the requirements for information about the status of the network. It is more important not only to indicate problems when they occur, but to prevent them and this can only be achieved by continuous measurement.

Control of power distribution

Substations

- ☑ measurement, monitoring, control and integrated protections,
- ☑ centralized/distributed system,
- ☑ optical communication with optional redundant ring.

A typical product used in substations is the modular version RTU7M in bigger chassis (8, 10, 16 slots) due to the requirement for greater numbers of inputs and outputs in systems. Individual RTUs can be connected and cascaded into larger system and some of the units can be designated as data concentrator which communicates with the higher system (SCADA). Due to the extensive communication abilities, our RTUs can be used in new installations, but also for retrofitting.

Overhead lines

- ☑ remote monitoring and control of reclosers and remotely controlled disconnectors,
- ☑ reclosers – automatic disconnection in the case of failure, reclosing,
- ☑ disconnectors – automatic disconnection in voltage-free pause,
- ☑ measurements of currents and voltages,
- ☑ fault detection (overcurrent, short circuit, current asymmetry, overvoltage, undervoltage, earth fault, incorrect frequency).

This area of applications has several solution options depending on the approach and requirements of the investor. In some distribution companies, only some current faults are indicated, which is stated by the fact that voltage and current sensors for outdoor use are important items in budgets. However, the best results in terms of evaluating the situation in the network are achieved in the case of complex current and voltage measurement. As a result, the whole range of protective functions exactly indicates the type and position of the problems in the network. Due to the fact that the RTU can analyze the records, then the exact reason of the problem can be stated and a service team can be sent to the site with more precise information about the position and type of defect. The end result is significantly shorter time for removing the defect and the resulting economic effect.

The most frequently used configurations for these applications are the compact RTU7K or modular RTU7M in five slots chassis equipped with the required communications, measurement inputs and digital inputs and outputs.
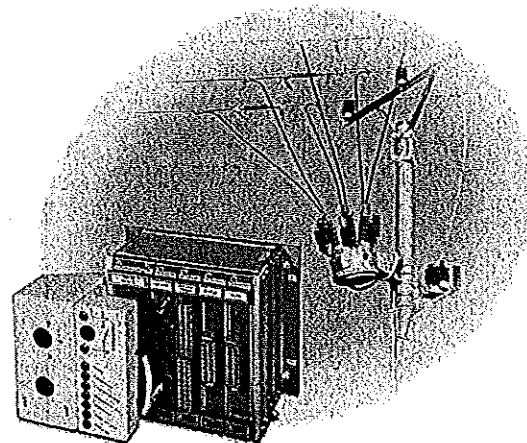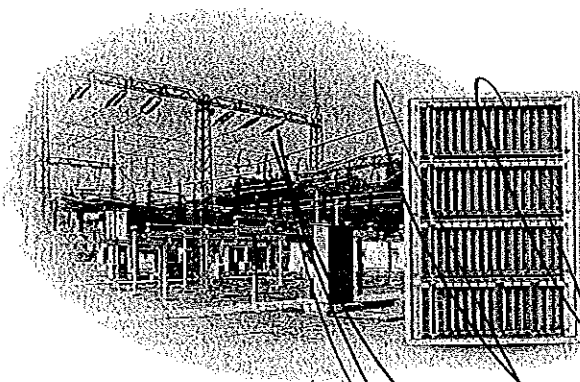
Cable networks

- ☑ measurement of currents,
- ☑ faults indication (overcurrent, short circuit, earth fault, current asymmetry),
- ☑ monitoring of binary signals (door contact, protective elements),
- ☑ remote control option.

For medium voltage cable networks, it is usually sufficient to measure only currents, because the external influences on the voltage level are limited. This fact significantly decreases solution costs, because it eliminates the need to invest into voltage sensors and measuring inputs.

The space saved in the RTU configuration can be used for the installing a higher number of current inputs. As a result, the compact RTU7.4 version can use up to 4 groups of 3-phase measurements (in total 12 inputs), which is usually sufficient for monitoring of whole distributional transformer station (MV/LV substation).

For modular versions of the RTU7M a similar solution can be used with cards RTU7M M3ZQ, where in addition to the option to measure and monitor medium voltage, there is the option to measure and monitor directly currents and voltages on low voltage side using the cards EP-3U/xxx/3I/xxx in the function of an indicator, as well as for complete protection. By combining these cards in one system, it is possible to resolve the control and measurement of the distributional transformer stations for both medium and low voltage sides. It significantly contributes to the solution from the viewpoint of the monitoring and control of networks, where a renewable energy sources are connected that can cause problematic fluctuations in the network. It is possible to easily locate such problems with our systems and repair them in time. Similarly, such solutions can also be applied to older networks where problems are caused by the age or improper connection of networks (e.g. unbalanced loading of phases, etc.).
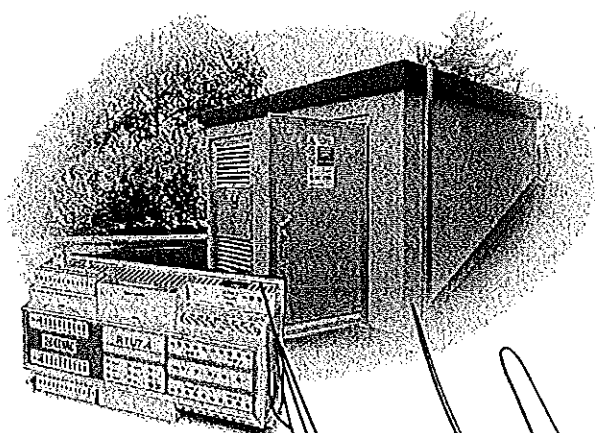
Dispatching control of renewable energy sources

System features

- ☑ measurement of P, Q, U , I and derived values,
- ☑ remote control of performance,
- ☑ data providing to a plant operator,
- ☑ communication with SCADA via GSM/GPRS using the protocol IEC 60870-5-104,
- ☑ optional connection of another sensors via RS-485 or Ethernet using the protocol MODBUS,
- ☑ short delivery times, superior technical support,
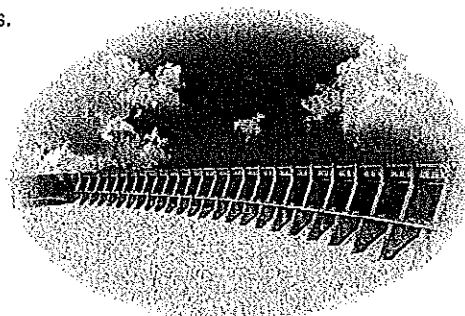- ☑ possible modifications according to the request of the client.

RTU7KL units are most frequently used for these applications, or alternatively similar configurations of the modular RTU7M, where further sensors or required interfaces can be added due to the wider selection of cards.
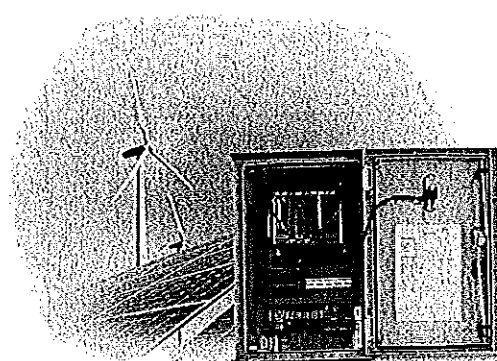
Control of other energy sources

As mentioned previously, RTU are usually fitted with inputs, outputs and communication interfaces that can be used in a wide spectrum of applications, not just in the power distribution. However, for these purposes, a slightly different processing of signals is required concerning the speed, as well as the length of the records, etc. It is possible to use units with adjusted firmware for control of such resources, like:

- ☑ heat,
- ☑ water,
- ☑ gas.

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Enterprise energetics

Energies are the basic input into production and therefore it is very important to monitor these resources and to control the processes of their management. The basic and the most frequently used resource of energy in companies is, of course, electricity and in this area the principles of control are similar to traditional electricity distribution, only in smaller scope. In industrial enterprises, important energy resources are also gas, heat or water.

All these resources can be monitored in a similar way, only the types of sensors are different for the stated types of energies. All data is then concentrated and sent to the control room and other databases serving for various purposes, e.g. sales and service systems.

Similar types of RTUs as for the above-mentioned applications in distribution systems are used for control and monitoring of electric energy. For other types of energies, it is recommended to modify the method of data evaluation, because it has other requirements for the speed and length of the data storage. Therefore ELVAC offers different types of RTUs recommended for measurement and control of electric energy, as well as for other energies.

ELVAC provides also products that complete RTU systems and together they form a complex control system. These include the Mikrodispečink SCADA system, redundant power supplies, large screens with rear projection or multi-displays.

Control system ELVAC RTU
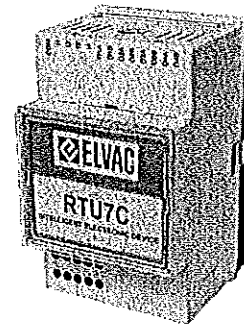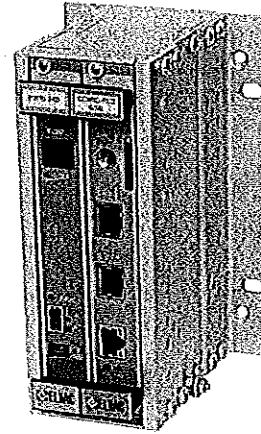Scheme of redundant communication
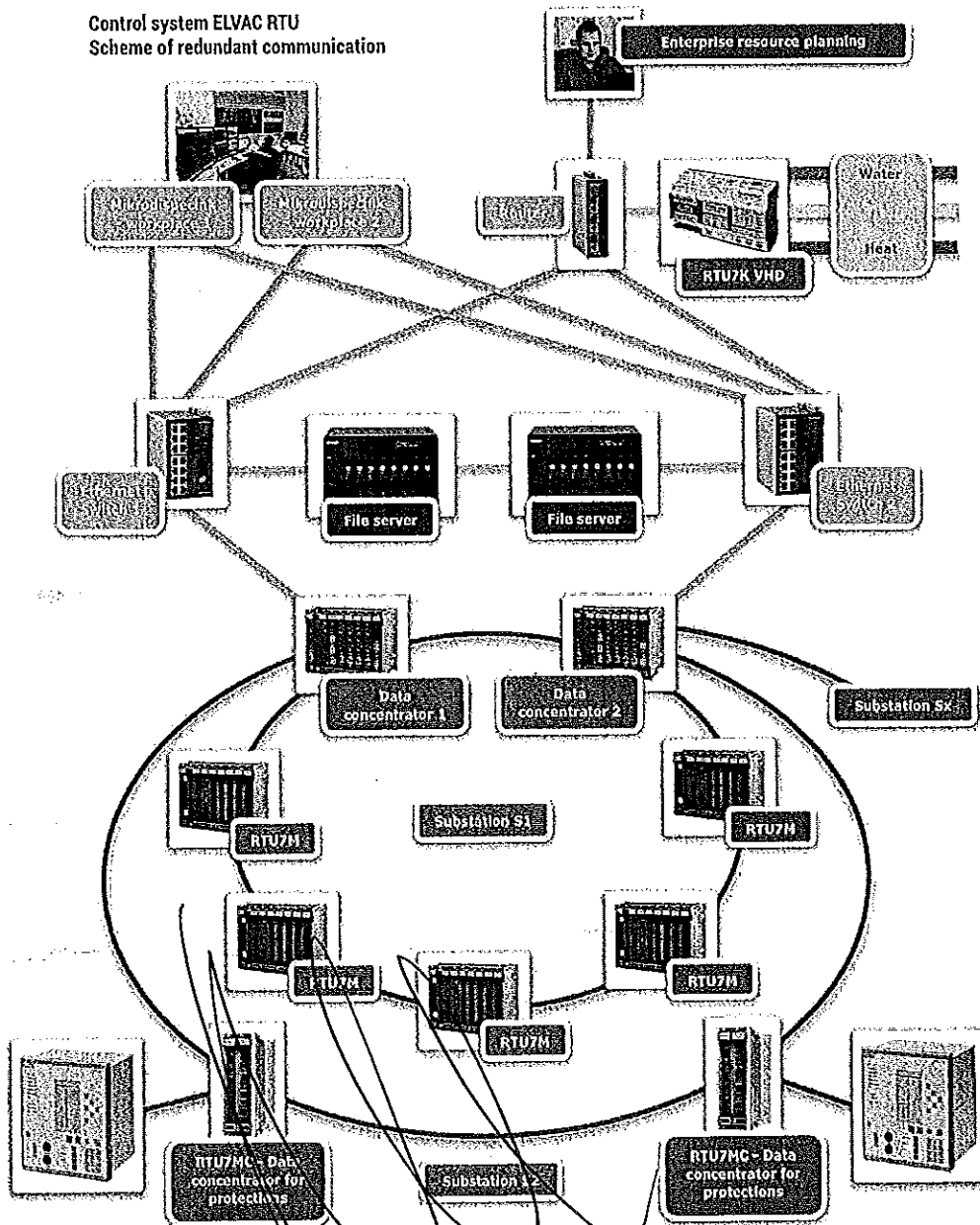
Other applications

Communication converters – communication modules with built-in PC (e.g. RTU7M COMIO PC2) are strong tools for conversion of communication between various protocols used in energy sector, e.g. IEC 60870-5-101, IEC 60870-5-104, IEC 60870-5-103, DNP3 and others. The conversion of the communication can run between devices or with the SCADA system.
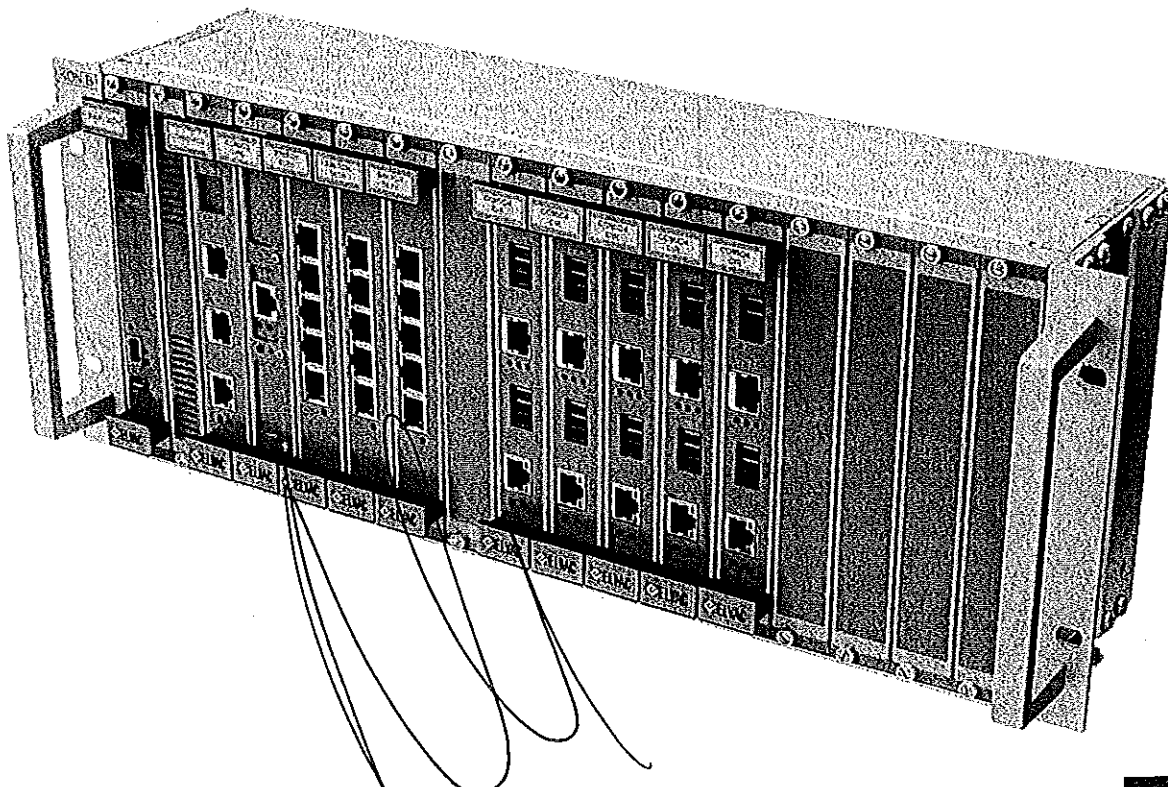
Communication gates – not all devices, especially the older ones, have the communication resolved. Connection to ELVAC products (e.g. RTU7C) resolves this problem at an acceptable price.

Time synchronization in systems – besides many other interfaces, ELVAC RTUs can be equipped with GPS interface, which is used for obtaining of exact time. This information can be provided further to the devices in the system.

Data concentrators – ELVAC RTUs have wide communication abilities. If there are many devices in the network then it can be more effective, or in some cases it is even necessary, to concentrate data in the stated nodes and then send it to the master system. In this way, data can be collected from various types of interfaces and protocols. Everything can be implemented as redundant system which can communicate with the master system, e.g. via two separate channels or, for example, it is possible to communicate within subordinated systems in the ring connection. The modular version of the concentrators can be designed according to the demands of applications.
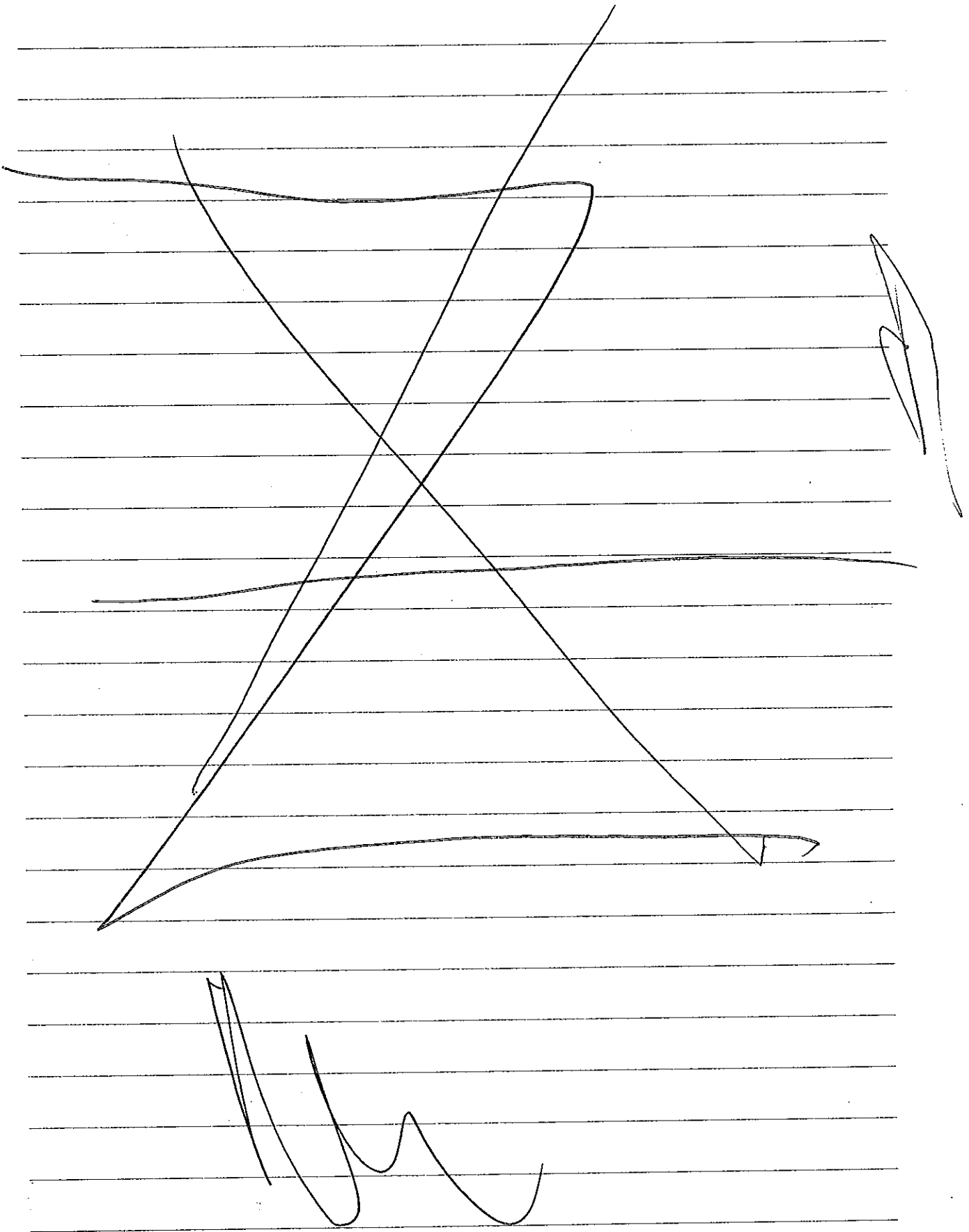
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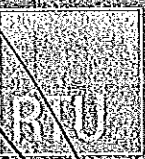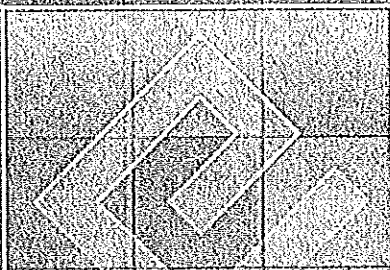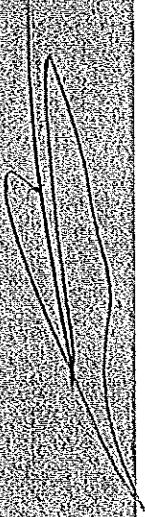
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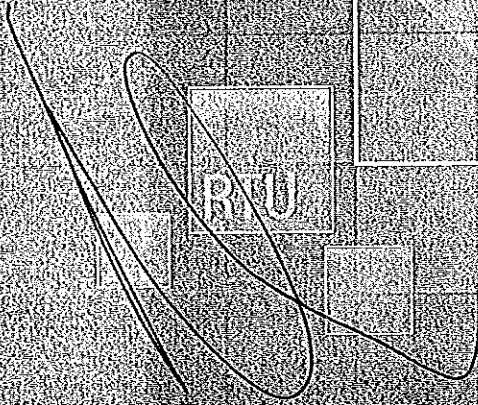
Compact RTU

RTU7.4 (PC2) – control and communication unit, measurement 4 × 3I

Unit description

The RTU7.4 is derived from a well-established series of compact RTUs from ELVAC a.s., designed for remote monitoring of energy networks, and further areas with high requirements for system reliability and robustness. The compact design integrates in one unit four three-phase measurement of currents, digital inputs and outputs, a communication module and a charger of backup batteries which is very cost-effective and simplifies system installation and maintenance. The unit can record the waveforms of signals on analogue inputs triggered from fault events. These records can be remotely downloaded and analyzed. Similarly, it is possible to remotely parameterize the unit and upgrade firmware. The RTU7.4 PC2 version is fitted with a more powerful communication card to support more demanding communication tasks.

Typical applications

☑ indicator of fault currents in cable grids.
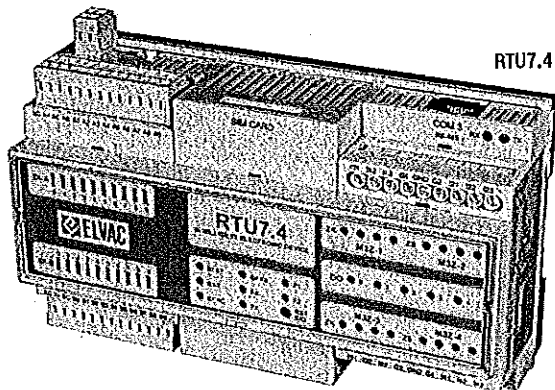
RTU7.4

Basic features of unit

☑ 20 × digital input, periodical evaluation and filtering of input changes,

☑ 4 × three-phase measurement of currents, periodical evaluation of values,

☑ 5 × relay output, automation functions,

☑ auxiliary contact ON REL, useful for example for disconnection of a devices connected to battery,

☑ internal temperature of RTU is measured directly, another input for external sensor for environment measurement of RTU,

☑ external power supply 10 V DC to 40 V DC, the voltage must be 5 V higher than voltage of a backup battery,

☑ controlled charging of backup battery 12 V or 24 V, periodical testing of battery status (capacity),

☑ time analysis of measured values with option of recording and remote downloading of records,

☑ signaling of earth fault, overcurrent, short circuit, optional choice of automation functions,

☑ time information is provided by master system (SCADA) or via GPS receiver,

☑ the number of inputs or outputs of RTU can be extended with another external modules or RTUs via RS-485,

☑ optional control via HMI terminals,

☑ communication card COMIO4 - RS-232/485, Ethernet, GPRS/EDGE/UMTS, version PC2 additionally RS-422, CSD,

☑ supported communication protocols – MODBUS, HIOCom2, IEC 60870-5-101, IEC 60870-5-103, IEC 60870-5-104, FTP, HTTP,

☑ version RTU7.4 PC2 supports also IEC 61850, DNP3, L2TP, secured communication according to IEC TS 62351-3 and another option according to user demands,

☑ user programming by logical and relational expressions,

☑ DIN rail or panel mounting.

Technical specification

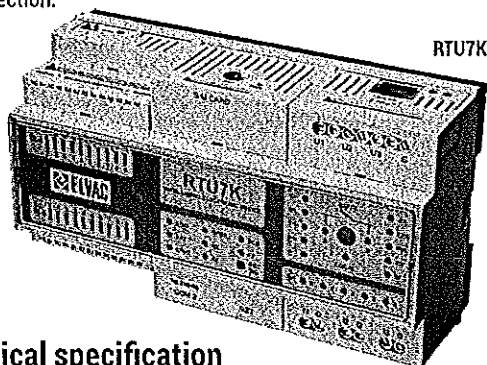|	
Current inputs	4 × (3 × 20 mA AC/DC)
Digital inputs	20 × optocoupler, active or passive inputs, excitation voltage 24 V (optionally 12 V)
Digital outputs	4 × relay (NO contact), 1 × relay (changeover contact)
Communication cards	Standard COMIO4, optionally card COMIO-PC2 with embedded PC
Communication interfaces	Depending on the type of communication card - Ethernet LAN, GPRS/EDGE/UMTS, RS-232/422/485
Antenna connector	FME with card COMIO4 or SMA with card COMIO PC2
Power supply voltage	10 V DC to 40 V DC
Voltage of backup battery	12 V, optionally 24 V
Max. charging current of battery	1 A
Max. maintenance battery voltage	13.7 V, optionally 27.4 V
Switch off voltage (battery protection)	11 V, optionally 22 V
Temperature sensor	Measured range -55 °C to 125 °C, accuracy ±0.5 °C in range -10 °C to 85 °C
Operating temperature	25 °C to 50 °C
Storage temperature	30 °C to 75 °C
Ambient relative humidity	30 % to 95 % non-condensing
Dimensions	157 × 90 × 60 mm (W × H × D) without connectors
Ingress protection	IP20 (IP21 with protection cover - for free on demand)

RTU7K (PC2) – control and communication unit, measurement 3V + 3I

Unit description

The RTU7.4 is derived from a well-established series of compact RTUs from ELVAC a.s., designed for remote monitoring of energy networks, and further areas with high requirements for system reliability and robustness. The compact design integrates in one unit three-phase measurement of voltages and currents, digital inputs and outputs, a communication module and a charger of backup batteries which is very cost-effective and simplifies system installation and maintenance. The unit can record the waveforms of signals on analogue inputs triggered from fault events. These records can be remotely downloaded and analyzed. Similarly, it is possible to remotely parameterize the unit and upgrade firmware. The RTU7K PC2 version is fitted with a more powerful communication card to support more demanding communication tasks.

Typical applications

☑ measurement of P, Q, U, I,
☑ reclosers and disconnectors control,
☑ protection.

RTU7K

Basic features of unit

☑ 20 × digital input, periodical evaluation and filtering of input changes,
☑ three-phase measurement of voltages and currents, periodical evaluation of values,
☑ 5 × relay output, automation functions,
☑ auxiliary contact ON REL, useful for example for disconnection of a devices connected to battery,
☑ internal temperature of RTU is measured directly, another input for external sensor for environment measurement of RTU,
☑ external power supply 10 V DC to 40 V DC, the voltage must be 5 V higher than voltage of a backup battery,
☑ controlled charging of backup battery 12 V or 24 V, periodical testing of battery status (capacity),
☑ protections – short circuit, overcurrent (time depending or not, directional or not), earth fault (directional or not) voltage, frequency, current and voltage asymmetry,
☑ automation functions – reclosing, switch off in zero voltage pause,
☑ time information is provided by master system (SCADA) or via GPS receiver,
☑ optional extension via RS-485 – external I/O modules, another RTUs
☑ optional control via HMI terminals,
☑ communication card COMIO4 - RS-232/485, Ethernet, GPRS/EDGE/UMTS, version PC2 additionally RS-422, CSD,
☑ supported communication protocols – MODBUS, HIOCom2, IEC 60870-5-101, IEC 60870-5-103, IEC 60870-5-104, FTP, HTTP,
☑ version RTU7K PC2 supports also IEC 61850, DNP3, L2TP, secured communication according to IEC TS 62351-3 and another option according to user demands,
☑ user programming by logical and relational expressions,
☑ DIN rail or panel mounting.

Technical specification

Voltage inputs	3 × 10 or 100 or 230 V AC (DC), optionally fourth input 100 V or inputs for capacitive sensors
Current inputs	3 × 20 mA, optionally 1 A AC (DC)
Digital inputs	20 × optocoupler, active or passive inputs, excitation voltage 24 V (optionally 12 V)
Digital outputs	4 × relay (NO contact), 1 × relay (changeover contact)
Communication cards	Standard COMIO4, optionally card COMIO-PC2 with embedded PC
Communication interfaces	Depending on the type of communication card - Ethernet LAN, GPRS/EDGE/UMTS, RS-232/422/485
Antenna connector	FME with card COMIO4 or SMA with card COMIO PC2
Power supply voltage	10 V DC to 40 V DC
Voltage of backup battery	12 V, optionally 24 V
Max. charging current of battery	1 A
Max. maintenance battery voltage	13.7 V, optionally 27.4 V
Switch off voltage (battery protection)	11 V, optionally 22 V
Temperature sensor	Measured range -55 °C to 125 °C, accuracy ±0.5 °C in range -10 °C to 85 °C
Operating temperature	-25 °C to 60 °C
Storage temperature	-30 °C to 75 °C
Ambient relative humidity	80 % to 95 % non-condensing
Dimensions	157 × 90 × 60 mm (W × H × D) without connectors
Ingress protection	IP20 (IP21 with protection cover – for free on demand)

RTU7K SE – control and communication unit, measurement 4V + 4I

Unit description

The RTU7K SE unit is a new generation of compact RTUs for remote monitoring of energy networks and other areas with high demands for reliability and robustness. The unit uses a new type of the CPU and A/D converter with higher measurement accuracy (according to the configuration of analogue inputs up to 0.2% - 0.3 % of the measuring range). The number of analogue inputs is expanded to 8, which enables, for example, I_0 and U_0 direct measurement.

New intelligent battery charger can charge a battery within the whole range of power supply voltages. The RTU7K SE provides protective and automation functions and is able to record the waveforms of signals on analogue inputs triggered from fault events. Remote downloading of records, parameterization and FW upgrades are a matter of course.

Typical applications

- reclosers and disconnectors control,
- measurement of P, Q, U, I
- monitoring and control of renewable sources or MV/LV substations
- indicator of fault currents
- protection

RTU7K SE

Basic features of unit

- 16 × digital input, periodical evaluation and filtering of input changes,
- 16bit three-phase measurement of voltages and currents, periodical evaluation of values,
- 8 × relay output, automation functions,
- auxiliary contact ON REL, useful for example for disconnection of a devices connected to battery,
- internal temperature of RTU is measured directly, another input for external sensor for environment measurement of RTU,
- external power supply 10 V DC to 40 V DC,
- controlled charging of backup battery 12 V or 24 V, periodical testing of battery status (capacity),
- measured values evaluation in time with option of waveform recording,
- protections – short circuit, overcurrent (time depending or not, directional or not), earth fault (directional or not) voltage, frequency, current and voltage asymmetry,
- automation functions – reclosing, switch off in zero voltage pause,
- time information is provided by master system (SCADA) or via GPS receiver,
- optional extension via RS-485 – external I/O modules, another RTUs
- optional control via HMI terminals,
- communication interfaces RS-232/422/485, Ethernet, GPRS/EDGE/UMTS, CSD,
- supported communication protocols – MODBUS, HIOCom2, IEC 60870-5-101, IEC 60870-5-103, IEC 60870-5-104, FTP, HTTP, IEC 61850, DNP3, L2TP, secured communication according to IEC TS 62351-3 and another option according to user demands,
- user programming by logical and relational expressions,
- DIN rail or panel mounting.
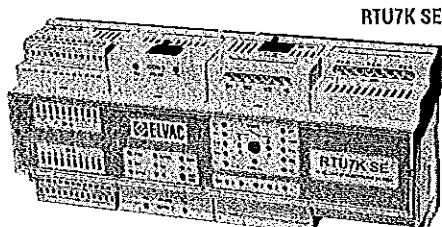
Technical specification

Availability Q3/2015

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Voltage inputs	Optional 4 × 100 V AC (DC) or 4 × 230 V AC (DC) or inputs for capacitive sensors and others
Current inputs	Optional 4 × 20 mA AC (DC) or 4 × 1 A AC (DC) and others
Digital inputs	16 × optocoupler, active or passive inputs, excitation voltage 24 V (optionally 12 V)
Digital outputs	8 × relay (NO contact)
Communication interfaces	Ethernet LAN, GPRS/EDGE/UMTS, RS-232/422/485
Antenna connector	SMA
Power supply voltage	10 V DC to 40 V DC
Voltage of backup battery	12 V, optionally 24 V
Max. charging current of battery	1 A
Max. maintenance battery voltage	13.7 V, optionally 27.4 V
Switch off voltage (battery protection)	11 V, optionally 22 V
Temperature sensor	Measured range -55 °C to 125 °C, accuracy ±0.5 °C in range -10 °C to 85 °C
Operating temperature	-25 °C to 50 °C
Storage temperature	-30 °C to 75 °C
Ambient relative humidity	30 % to 95 % non-condensing
Dimensions	210 × 90 × 60 mm (W × H × D) without connectors
Ingress protection	IP20 (IP21 with protection cover – for free on demand)

RTU7KL (PC2) – control and communication unit, measurement 3V + strengthened 3I

Unit description

The RTU7.4 is derived from a well-established series of compact RTUs from ELVAC a.s., designed for remote monitoring of energy networks, and further areas with high requirements for system reliability and robustness. The unit integrates three-phase measurement of voltages and currents (current inputs for 1A or 5A), digital inputs and outputs, a communication module and a charger of backup batteries. The unit can record the waveforms of signals from analog inputs triggered from fault events. Remote downloading of records, parameterization and FW upgrades are a matter of course. The RTU7KL PC2 version is fitted with a more powerful communication card to support more demanding communication tasks.

Typical applications

- ☑ measurement of P, Q, U, I,
- ☑ monitoring and control of renewable sources,
- ☑ monitoring and control of MV/LV substations,
- ☑ protection.
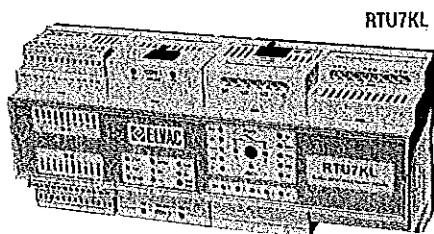
RTU7KL

Basic features of unit

- ☑ 20 × digital input, periodical evaluation and filtering of input changes,
- ☑ three-phase measurement of voltages and currents, periodical evaluation of values,
- ☑ 5 × relay output, automation functions,
- ☑ auxiliary contact ON REL, useful for example for disconnection of a devices connected to battery,
- ☑ internal temperature of RTU is measured directly, another input for external sensor for environment measurement of RTU,
- ☑ external power supply 10 V DC to 40 V DC, the voltage must be 5 V higher than voltage of a backup battery,
- ☑ controlled charging of backup battery 12 V or 24 V, periodical testing of battery status (capacity),
- ☑ protections – short circuit, overcurrent (time depending or not, directional or not), earth fault (directional or not) voltage, frequency, current and voltage asymmetry,
- ☑ automation functions – reclosing, switch off in zero voltage pause,
- ☑ time information is provided by master system (SCADA) or via GPS receiver,
- ☑ optional extension via RS-485 – external I/O modules, another RTUs,
- ☑ optional control via HMI terminals,
- ☑ communication card COMIO4 - RS-232/485, Ethernet, GPRS/EDGE/UMTS, version PC2 additionally RS-422, CSD,
- ☑ supported communication protocols – MODBUS, HIOCom2, IEC 60870-5-101, IEC 60870-5-103, IEC 60870-5-104, FTP, HTTP,
- ☑ version RTU7KL PC2 supports also IEC 61850, DNP3, L2TP, secured communication according to IEC TS 62351-3 and another option according to user demands,
- ☑ user programming by logical and relational expressions,
- ☑ DIN rail or panel mounting.

Technická specifikace

Voltage inputs	3 × 10 or 100 or 230 V AC (DC), optionally fourth input 100 V or inputs for capacitive sensors
Current inputs	3 × 1 A AC or 3 × 5 A AC
Digital inputs	20 × optocoupler, active or passive inputs, excitation voltage 24 V (optionally 12 V)
Digital outputs	4 × relay (NO contact), 1 × relay (changeover contact)
Communication cards	Standard COMIO4, optionally card COMIO-PC2 with embedded PC
Communication interfaces	Depending on the type of communication card - Ethernet LAN, GPRS/EDGE/UMTS, RS-232/422/485
Antenna connector	FME with card COMIO4 or SMA with card COMIO-PC2
Power supply voltage	10 V DC to 40 V DC
Voltage of backup battery	12 V, optionally 24 V
Max. charging current of battery	1 A
Max. maintenance battery voltage	13.7 V optionally 27.4 V
Switch off voltage (battery protection)	11 V, optionally 22 V
Temperature sensor	Measured range -55 °C to 125 °C, accuracy ±0.5 °C in range -10 °C to 85 °C
Operating temperature	-25 °C to 50 °C
Storage temperature	-30 °C to 75 °C
Ambient relative humidity	30 % to 95 % non-condensing
Dimensions	210 × 90 × 60 mm (W × H × D) without connectors
Ingress protection	IP30 (IP21 with protection cover - for free on demand)

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RTU7C – control and communication unit

Unit description

The RTU7C is derived from a well-established series of compact RTUs from ELVAC a.s., designed for remote monitoring of energy networks, and further areas with high requirements for system reliability and robustness. The compact design integrates in one unit a communication module, digital inputs and outputs.

This compact unit is internally resolved as a modular system which enables high flexibility and the possibility to adapt to requirements of the client. An example is the wide range of communication interfaces ((E)GPRS, UMTS, Ethernet, RS-232, RS-485), which can be fitted into the unit in various combinations. Various communication protocols can be set for each communication interface. It is possible to communicate via several protocols in one time, for example with protocol IEC 60870-5-104 into the master system and protocol HioCom2 into the parameterization SW (remote parameterization, signal transmission, FW upgrade, etc.). Another communication options are various methods of backup communication.

Typical applications

- ☑ connection of devices without necessary communication,
- ☑ communication converter,
- ☑ communication gate.
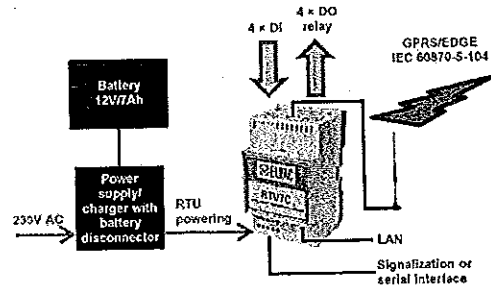
RTU7C
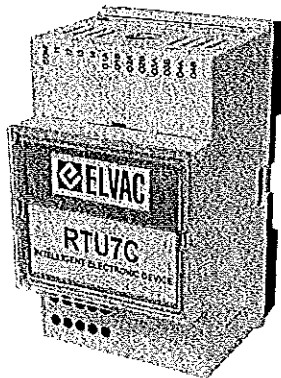
Basic features of unit

- ☑ 4 × digital inputs,
- ☑ 4 × relay outputs ,
- ☑ external power supply 10 V DC to 30 V DC,
- ☑ communication interfaces - GPRS/EDGE/UMTS, Ethernet, RS-232/485,
- ☑ supported communication protocols – MODBUS, HIOCom2, IEC 60870-5-101, IEC 60870-5-103, IEC 60870-5-104,
- ☑ user programming by logical and relational expressions,
- ☑ DIN rail or panel mounting.

Variant of connection RTU7C with power supply backup

Variant of connection RTU7C without power supply backup
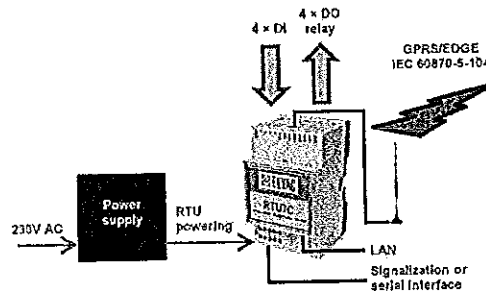
Technical specification

Digital inputs	4 × optocoupler, active or passive inputs, excitation voltage 24 V (optionally 12 V)
Digital outputs	4 × relay (NO contact)
Power supply voltage	10 V DC to 30 V DC
Consumption (all DO closed)	100 mA / 420 mA by 12 V DC
Communication interfaces	Ethernet LAN, GPRS/EDGE/UMTS, RS-232/485
Antenna connector	FME (m) 50 Ohm
Temperature sensor	Measured range -55 °C to 125 °C, accuracy ±0.5 °C in range -10 °C to 85 °C
Operating temperature	-25 °C to 50 °C
Storage temperature	-30 °C to 75 °C
Ambient relative humidity	30 % to 95 % non-condensing
Dimensions	53 × 90 × 60 mm (W × H × D) without connectors
Ingress protection	IP20

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ELVAC a.s.

SMC 144, SMC 133, PA 144, P 133 – power monitors and data loggers

Unit description

All four products are designed for remote monitoring of electricity in power lines and its quality in class S. These devices have not display, so it is cost optimized solution for the applications with SCADA system, where local reading of data is not used.

Measured data can be stored into database and then analyzed and evaluated in SW application ENVIS (free of charge). System can send regular reports about the power quality in given time period or can send automatic alarms, if some events exceed the set values.

PA devices are for measuring of actual values, SMC furthermore features large internal memory for data logging of measured values.

Typical applications

- ☑ Power quality metering.
- ☑ Remote monitoring of energy consuption.

SMC 144
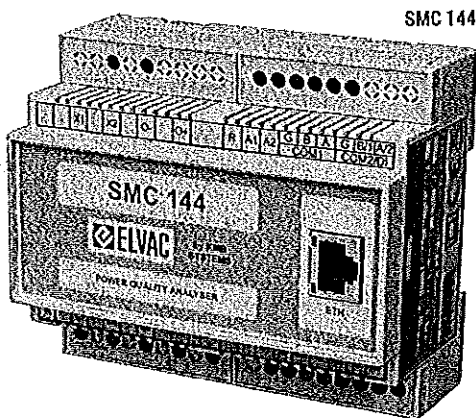
Basic features of unit

- ☑ Three or four independent voltage and current inputs (4x1p, 3p-wye, 3p-delta),
- ☑ energy meter supports 3 tariffs, single and threephase measurement in four quadrants for active and reactive energy,
- ☑ measurement U, I, P, Q, S, harmonic distortion power, PF, cos φ, symetrical components, unbalance factor, THD, 50 harmonics, fundamental harmonics, frequency, active energy, reactive energy,
- ☑ 512MB memory for data logging (only SMC 133 and SMC 144),
- ☑ internal battery for 1 hour power backup (only SMC 133 and PA 133),
- ☑ optionally 2 × digital input, 2 × digital output (only SMC 144 and PA 144),
- ☑ communication interface RS-485, optionally Ethernet or USB,
- ☑ communication protocol MODBUS,
- ☑ standards IEC61557-12, EN50160, class S,
- ☑ DIN rail mounting.

Ordering options

PA 133	power quality monitor with 3V + 3I inputs with battery backup, 300V/CAT IV
PA 144	power quality monitor with 4V + 4I inputs
SMC 133	power quality monitor and data logger with 3V + 3I inputs with battery backup, 300V/CAT IV
SMC 144	power quality monitor and data logger with 4V + 4I inputs

Technical specification

Voltage inputs SMC 133 and PA 133	3 × 8 to 620 V$_{ll}$ or 6 to 360 V$_{LN}$ (wye, delta, aron)
Voltage inputs SMC 144 and PA 144	4 × 4 to 500 V$_{ll}$ or 2.3 to 285 V$_{LN}$ (wye, delta, aron)
Current inputs	3 or 4 × 100 mA AC
Digital inputs	Only SMC 144 and PA 144 - optionally 2 × DI (12-24 V)
Digital outputs	Only SMC 144 and PA 144 - optionally 2 × DO
Communication interfaces	RS-485, optionally Ethernet or USB
Power supply voltage	Optional 12 V DC / 24 V DC / 48 V DC, SMC 144 and PA 144 also 230 V AC
Consuption	3W
Operating temperature	-25 °C to 60 °C
Storage temperature	-40 °C to 85 °C
Ambient relative humidity	30 % to 95 % non-condensing
Dimensions	105 × 90 × 98 mm (W × H × D)
Ingress protection	IP20

SMY 133 – power monitor and data logger with display

Unit description

The SMY 133 is advanced 3-phase multimeter with large color LCD display designed for local or remote monitoring of electricity in power lines and its quality in class S.

Measured data can be stored into database and then analyzed and evaluated in SW application ENVIS (free of charge). System can send regular reports about the power quality in given time period or can send automatic alarms, if some events exceed the set values.

Digital outputs can also work as an S0 pulse output from the embedded electricity meter.

SMY 133

Typical applications

☑ Power quality metering.
☑ Remote monitoring of energy consuption.

Basic features of unit

☑ Three voltage and current inputs 1p, 3p-wye, 3p-delta, Aron,
☑ energy meter supports 3 tariffs, single and threephase measurement in four quadrants for active and reactive energy,
☑ measurement U, I, P, Q, S, harmonic distortion power, PF, cos φ, symetrical components, unbalance factor, THD, 50 harmonics, fundamental harmonics, frequency, active energy, reactive energy,
☑ built-in temperature sensor,
☑ 512MB memory for data logging,
☑ optionally 2 × digital input, 2 × digital output,
☑ USB communication interface, optionally RS-485 or Ethernet,
☑ optional communication protocol MODBUS,
☑ standards IEC61557-12, EN50160, class S,
☑ panel mounting.
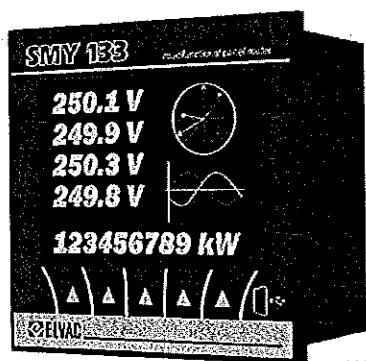
Technical specification

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Voltage inputs	Optionally 3 × 100 V / 230 V / 400 V
Overvoltage category	230, 400: CAT III / 300 V 100: CAT IV / 150 V
Current inputs	Optionally 3 × 100 mA / 5 A
Current inputs overload	100mA: 1 mA ÷ 390 mA (max. 10A/1s) 5A: 5 mA ÷ 7 A (max. 70A/1s)
Digital inputs	Optionally 1 × DI (24 V)
Digital outputs	Optionally 2 × DO
Communication interfaces	USB, optionally RS-485 or Ethernet
Power supply voltage	Optionally 230 V AC / 12 V DC / 24 V DC / 48 V DC
Consuption	3W
Operating temperature	-25 °C to 60 °C
Storage temperature	-40 °C to 80 °C
Ambient relative humidity	30 % to 95 % non-condensing
Dimensions	96 × 96 × 64 mm (W × H × D)
Installation depth	58 mm
Mounting hole dimmensions	92 × 92 mm (W × H)
Ingress protection	IP40

ARTIQ 144 – class A power quality analyser

Unit description

The ARTIQ 144 is designed for remote monitoring of energy consuption and its quality in class A. The device has not display, so it is cost optimized solution for the applications with SCADA system, where local reading of data is not used.

Measured data can be stored into database and then analyzed and evaluated in SW application ENVIS (free of charge). System can send regular reports about the power quality in given time period or can send automatic alarms, if some events exceed the set values.
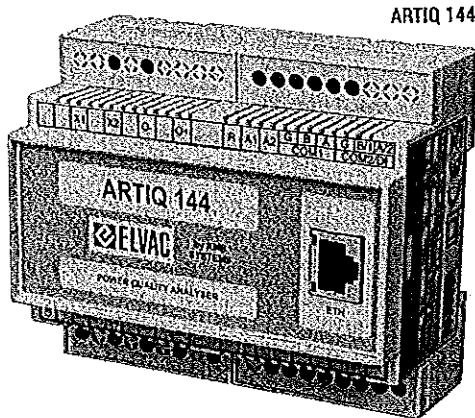
Typical applications

☑ Power quality metering in critical points.
☑ Advanced remote monitoring of distribution networks.
☑ Advanced energy management.

Basic features of unit

☑ Four independent voltage and current inputs (4x1p, 3p-wye, 3p-delta),
☑ energy meter supports 3 tariffs, single and threephase measurement in four quadrants for active and reactive energy,
☑ measurement U, I, P, Q, S, deformed power, PF, cos φ, THD, 128 harmonics, fundamental harmonics, unbalance factor, symetrical components, frequency, active energy, reactive energy,
☑ data logging,
☑ optionally 2 × digital input, 2 × digital output,
☑ communication interface RS-485, optionally Ethernet, M-Bus or USB,
☑ communication protocol MODBUS,
☑ standards IEC61557-12, EN50160, class A.
☑ DIN rail mounting.

ARTIQ 144

Technical specification

Voltage inputs	4 × 1 to 1125 V$_{LL}$ or 1 to 850 V$_{LN}$ (wye, delta, aron)
Voltage inputs overload	permanently 1300 VRMS, surge 1950 VRMS for 1 s
Current inputs	4 × 100 mA AC
Current inputs overload	permanently 2 × I$_n$, surge 10 × I$_n$ for 1 s
Digital inputs	Optionally 2 × DI
Digital outputs	Optionally 2 × DO
Communication interfaces	RS-485, optionally Ethernet, M-Bus or USB
Power supply voltage	Optional 230 V AC or 12 V DC or 24 V DC
Consuption	5W
Operating temperature	-25 °C to 60 °C
Storage temperature	-40 °C to 85 °C
Ambient relative humidity	30 % to 95 % non-condensing
Dimensions	105 × 90 × 58 mm (W × H × D)
Ingress protection	IP20

SMK 133 – multifunctional 3-phase panel meter

Unit description

The SMK 133 is simple 3-phase multimeter designed for measuring and monitoring of line/phase voltages, currents, power, energy, PF, harmonics in single-phase and three-phase LV, MV and HV networks. Built-in temperature sensor allows to measure temperature in place of installation.

With an optional communication interface it can be used for remote monitoring application connected to some supervisory computer or a SCADA system. SMK 133 is very cost effective solution, which allows using this device for each outlet. Together with some other types of ELVAC RTUs it can create a complete system of monitoring and control on primary and secondary side of substations.

SMK 133

Typical applications

☑ General metering applications.
☑ Online monitoring of outlets.

Basic features of unit

☑ Up to three-phase measurement of voltages and currents, also Aron connection,
☑ optionally 1 × digital output,
☑ measurement U, I, P, Q, S, deformed power, PF, cos φ, THD, 50 harmonics, fundamental harmonics, unbalance factor, frequency, active energy, reactive energy,
☑ optional communication interface RS-485,
☑ optional communication protocol MODBUS,
☑ IEC62053-22 class 0.5S,
☑ panel mounting.
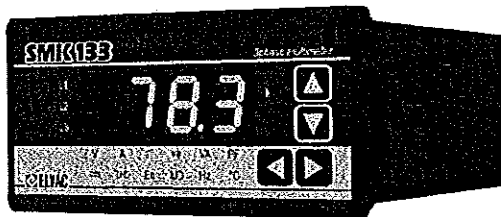
## Technical specification

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Voltage inputs	Optionally 3 × 100 V / 230 V / 400 V
Voltage inputs overload	Permanently 1300 V_{RMS}, surge 1950 V_{RMS} for 1s
Current inputs	Optionally 3 × 100 mA AC / 1 A / 5 A / 20 A throug-hole
Current inputs overload	Permanently 2 × I_n, surge 10 × I_n for 1 s
Digital outputs	Optionally 1 × DO
Communication interfaces	Optionally RS-485 with MODBUS protocol
Power supply voltage	Optionally from 1 phase or 230 V AC or 10 to 36 V DC
Operating temperature	-25 °C to 60 °C
Storage temperature	-40 °C to 85 °C
Ambient relative humidity	30 % to 95 % non-condensing
Dimensions	96 × 48 × 119 mm (W × H × D)
Installation depth	110 mm
Mounting hole dimmensions	92 × 44 mm (W × H)
Ingress protection	IP20

Modular RTU
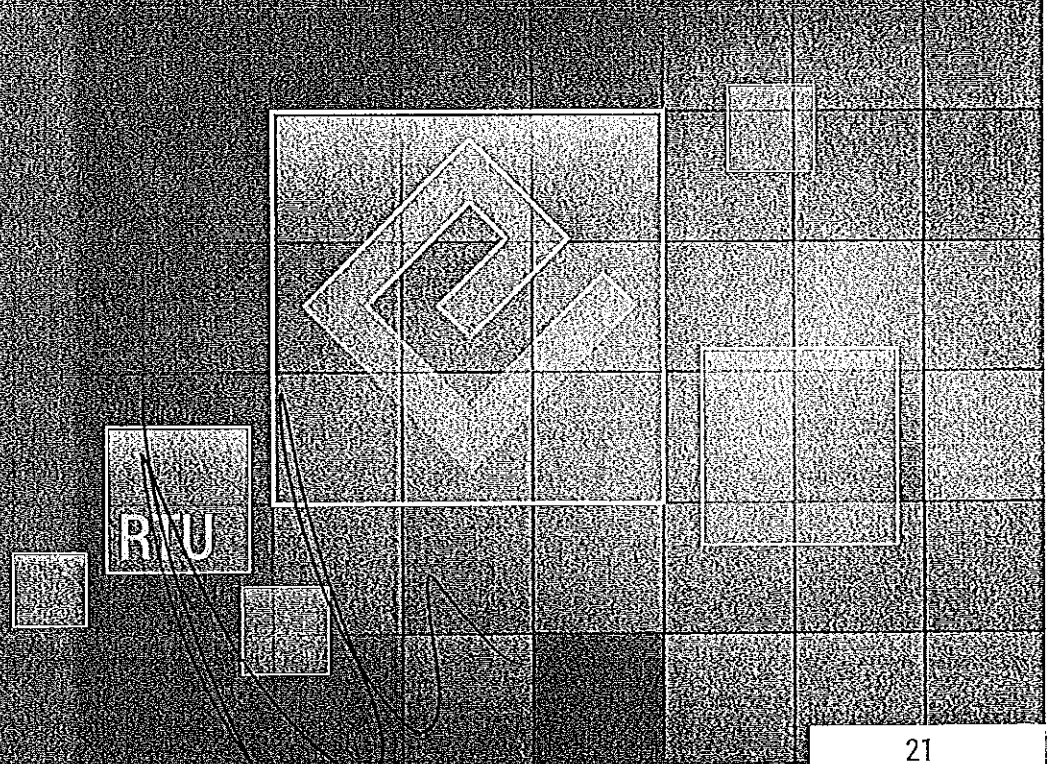
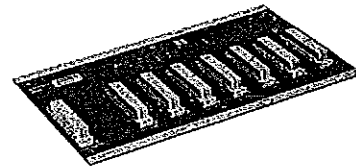# RTU7M – chassis, bus and CPU modules
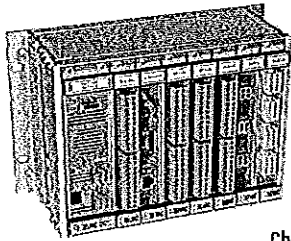
Chassis fitted with 8 cards

General description

The chassis consists of aluminum profiles and is adapted for mounting on the wall, panel, 19" rack (version with 16 slots), and also on DIN rails on demand. We offer versions for fitting with buses with 2, 5, 8, 10 and 16 slots. The bus is equipped with the CPU module on a special connector, representing the core of the entire RTU. Thus CPU module does not occupy any slot for insertion of cards.

Some slots are universal, some others are designed for inserting of specific types of cards. This is stated by the fact that the internal processor has a defined number of inputs and outputs. Cards which directly use CPU signals are called direct cards, indirect cards convert signals and communicate with the CPU by means of the communication line. All slots and cards have connectors with key, what protects against inserting an improper card into the slot. The specification, where it is possible to insert the specific type of card into the slot, is described for each card in the user manual for the modular RTU.

Module RTU7M CPU-02

Chassis for 5 cards with bus, without CPU module

Basic features

- ☑ chassis with bus with 2, 5, 8, 10 or 16 slots,
- ☑ keyed slots, protection against the insertion of improper card into the position,
- ☑ powerful signal processor (the core of RTU7M),
- ☑ modularity, easy expandability of I/O,
- ☑ integrated internal temperature sensor,
- ☑ 2 internal serial communication lines for communication with slave cards,
- ☑ synchronization line,
- ☑ circuit RTC with backup,
- ☑ wall, panel or 19" rack mounting,
- ☑ EMC/EMI compatibility.

Bus with 8 slots

Standards

The whole unit and its components were tested according to the following technical standards (unless stated otherwise in the detailed technical specifications of each card):
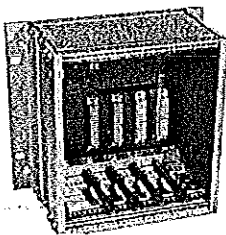
EMC:
ČSN EN 61000-4-2, ČSN EN 61000-4-3 ed.3, ČSN EN 61000-4-4 ed.2, ČSN EN 61000-4-5, ČSN EN 61000-4-6, ČSN EN 61000-4-7 ed.2, ČSN EN 61000-4-8, ČSN EN 61000-4-9, ČSN EN 61000-4-10, ČSN EN 61000-4-11 ed.2, ČSN EN 61000-4-12 ed.2, ČSN EN 61000-4-18, ČSN EN50130-4
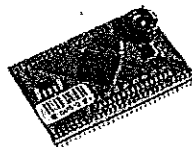
EMI:
ČSN EN 55022

Electrical safety:
ČSN EN 60950-1 ed.2

Technical specification

Labeling of chassis by number of slots	RTU7M CASE-2, RTU7M CASE-5, RTU7M CASE-8, RTU7M CASE-10, RTU7M CASE-16
Labeling of busses by number of slots	RTU7M BUS-2, RTU7M BUS-5, RTU7M BUS-8, RTU7M BUS-16 Note.: bus for 10 slots is made from buses 8+2
Labeling of CPU module	RTU7M CPU-02
Signal processor	16 bit
Measured range of temperature sensor	-55 °C to +125 °C, accuracy ±0.5 °C in range -10 °C to +85 °C
Operating temperature	-20 °C to +55 °C
Storage temperature	-30 °C to +75 °C
Ambient relative humidity	30 % to 95 % non-condensing
Ingress protection	IP20