ENSTO

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Revision A

PB50A-3P-200ADV

Modbus RTU Communication Protocol Specification

(CZE) PRÁVNÍ UPOZORNĚNÍ
- Montáž výrobku smí provádět pouze k tomu způsobilá osoba s odpovídajícím proškolením, praxí a s dostatečnými znalostmi bezpečnosti a postupů instalace ve vztahu k elektrickým zařízením. Pokud místní legislativa stanoví požadavky vztahující se k takovému proškolení nebo požadovaným znalostem ohledně montáže elektrického zařízení, musí výše uvedená osoba tyto požadavky splňovat.
- ENSTO nepřebírá žádnou odpovědnost ve vztahu k nárokům vyplývajícím z nesprávného použití nebo nesprávné montáže, anebo nerespektování národních předpisů bezpečnosti výrobků či jiných národních předpisů.
- UPOZORNĚNÍ: Nedodržení instrukce k montáži může mít za následek poškození výrobku nebo i vážné či smrtelné zranění.

(DAN) VIGTIG INFORMATION
- Dette produkt må kun installeres af personer med tilstrækkelig kundskab og uddannelse indenfor installationsarbejde samt sikkerheds- og arbejdsrutiner i forbindelse med elektrisk udstyr. Såfremt lokal lovgivning omfatter bestemmelser eller anbefalinger for uddannelse eller tilstrækkelig viden vedrørende installation af elektrisk udstyr, skal sådanne bestemmelser opfyldes af disse personer.
- Ensto accepterer intet erstatningsansvar i forbindelse med forkert anvendelse, fejlagtig installation af produkter eller manglende overholdelse af nationale sikkerhedsforskrifter eller øvrige bestemmelser.
- ADVARSEL: Forsømmelighed i at følge instruktionen kan resultere i skade på produktet eller i værste fald alvorlig eller fatal personskade.

(ENG) LEGAL NOTICE
- The product must be installed only by a competent person with sufficient training in installation practices and with sufficient knowledge of good safety and installation practices in respect of electrical equipment. If local legislation contains provisions in respect of such training or sufficient knowledge in respect of installation of electrical equipment such provisions shall be fulfilled by the said person.
- Ensto accepts no liability concerning claims resulting from misuse, incorrect installation or ignored national safety regulations or other national provisions.
- WARNING: Failure to follow the installation instructions may result in damage to the product and serious or fatal injury.

(EST) JURIIDILINE MÄRKUS
- Seda toodet tohib paigaldada ainult pädev, paigaldustöödes piisavat väljaõpet omav isik, kellel on piisavad teadmised elektriseadmete turva- ja paigaldustavadest. Kui kohalik seadusandlus või võrguettevõtja kehtestatud eeskiri sisaldab nõudeid niisuguse väljaõppe või elektriseadmete paigaldamiseks piisavate teadmiste kohta, peab paigaldaja neile nõudmistele vastama.
- Ensto ei vastuta nõuete eest, mis tulenevad väärkasutusest, ebaõigest paigaldusest või kehtivate turva- või muude reeglite eiramisest
- HOIATUS: paigaldusjuhiste järgimata jätmine võib kaasa tuua toote kahjustumise ja tõsise või surmava vigastuse.

(FIN) OIKEUDELLINEN ILMOITUS
- Tuotteen asennuksen saa suorittaa vain ammattitaitoinen henkilö, jolla on riittävät tiedot sähkölaitteiden asentamisesta ja sähköturvallisuudesta. Asennus tulee suorittaa voimassa olevia säädöksiä noudattaen. Lisäksi asennuksen suorittajan tulee täyttää kansallisen lainsäädännön asettamat pätevyysvaatimukset.
- Ensto ei vastaa vioista, jotka aiheutuvat tuotteen virheellisestä käytöstä, väärästä asennustavasta tai kansallisten turvallisuusmääräysten noudattamatta jättämisestä.
- VAROITUS! Asennusohjeiden vastainen asennus voi johtaa tuotteen vahingoittumiseen tai vakavaan onnettomuuteen.

(FRA) MENTIONS LÉGALES
- Seules des personnes formées et habilitées aux travaux sous tension BT peuvent mettre en oeuvre ce matériel sur un réseau sous tension. Le port des EPI adaptés et le respect des Conditions d'Exécution du Travail sous tension BT est de la responsabilité de l'opérateur. Le non-respect des instructions d'installation peut provoquer un endommagement du produit et des blessures graves, voire mortelles.
- Ensto n'assume aucune responsabilité quant à des réclamations découlant d'une mauvaise utilisation, d'une installation incorrecte ou d'une méconnaissance des règlements nationaux de sécurité..

(GER) RECHTLICHER HINWEIS
– Das Produkt darf nur von kompetenten und entsprechend geschulten Fachleuten installiert werden, die über ausreichende Kenntnisse im Arbeitsschutz und in der Elektroinstallation verfügen. Wenn das lokale Recht Bestimmungen hinsichtlich der Schulungen und Kenntnisse bei Elektroinstallation enthält, muss die entsprechende Person diese Bestimmungen erfüllen.
– Ensto übernimmt keine Haftung für Ansprüche, die auf Fehlgebrauch, fehlerhafte Montage oder die Nichtbeachtung nationaler Sicherheitsvorschriften oder anderer nationaler Bestimmungen zurückzuführen sind.
– ACHTUNG: Die Nichteinhaltung der Montageanweisungen kann Produktschäden und schwere oder sogar tödliche Verletzungen zur Folge haben.

(HUN) JOGI NYILATKOZAT
- Ezt a terméket csak olyan szakember szerelheti, aki részt vett a megfelelő elméleti, gyakorlati és biztonságtechnikai oktatáson, hálózatépítő szerlői tanfolyamon. Amennyiben a helyi szabályok megkövetelnek további képzettséget vagy szakmai tudást, úgy a szerelést végzőnek a fentieken túlmenően ezeknek is meg kell felelnie.
- Az Ensto nem vállal felelősséget a nem rendeltetésszerű használatból, helytelen vagy nem szakszerű szerelésből, az esetleges nemzeti biztonsági előírások figyelmen kívül hagyásából eredő károkért és következményekért.
- FIGYELEM: a szerelési utasítások megsértése a termék sérüléséhez vezethet, illetve súlyos vagy végzetes sérülést okozhat!

(ITA) NOTE LEGALI
- Il prodotto deve essere installato esclusivamente da persona competente con sufficiente formazione nelle pratiche di installazione e con sufficiente conoscenza delle norme di sicurezza e delle procedure di installazione per le apparecchiature elettriche. Qualora la legislazione locale preveda disposizioni relativamente a tale formazione o sufficiente conoscenza per quanto riguarda la installazione di apparecchiature elettriche, tali disposizioni dovranno essere adempiute da detta persona.
- Ensto non accetta nessuna responsabilità riguardo eventuali danni derivanti da uso improprio, installazione non corretta o che non rispetti le norme di sicurezza o altre disposizioni nazionali.
- ATTENZIONE: La non osservanza delle istruzioni per l'installazione può causare danni al prodotto e lesioni gravi o fatali.

(LAT) ATRUNA
- Produktu drīkst uzstādīt tikai attiecīgi kvalificēta persona, kura ir pietiekami labi apmācīta veikt šādu uzstādīšanu un kura ir pietiekami zinoša par drošības tehnikas noteikumiem un uzstādīšanas kārtību darbā ar elektroierīcēm. Ja nacionālie normatīvie akti paredz prasības vai īpašus noteikumus attiecībā uz šādu apmācību vai nepieciešamajām zināšanām darbā ar elektroierīcēm, tad minētajai personai šīs prasības un noteikumi ir jāievēro.
- Ensto neuzņemas nekādu atbildību par prasījumiem, kas cēlušies no nepareizas lietošanas, nepareizas uzstādīšanas, nacionālo drošības noteikumu vai citu noteikumu neievērošanas.
- UZMANĪBU: Uzstādīšanas instrukciju neievērošana var radīt kaitējumu produktam vai radīt smagus vai nāvējošus ievainojumus.

(LIT) TEISINIS PRANEŠIMAS
- Gaminį gali montuoti tik apmokytas asmuo, turintis vietos reikalavimus atitinkančią kvalifikaciją. Jei vietos įstatymai reikalauja - asmuo turi būti baigęs praktinius gaminio montavimo mokymų kursus.
- Ensto neatsako už atsitiktinę, netiesioginę ar pasekmių žalą, kurią padaro šio gaminio netinkamas panaudojimas, neteisingas montavimas, saugos ar kitų nacionalinių reikalavimų nepaisymas.
- DĖMESIO! Šios montavimo instrukcijos nurodymų nepaisymas gali sugadinti gaminį bei sukelti rimtą ar net mirtiną traumą.

(NOR) JURIDISK INFORMASJON
- Produktet må bare installeres av en kompetent person med tilstrekkelig opplæring i praktisk montasje og med tilstrekkelig kunnskap om sikkerhet og installasjonspraksis i forhold til elektrisk utstyr. Hvis lokal lovgivning inneholder bestemmelser om slik opplæring, eller om å inneha tilstrekkelig kunnskap i installasjon av elektrisk utstyr, skal slike bestemmelser oppfylles av vedkommende som utfører montasjen.
- Ensto tar ikke noe ansvar vedrørende krav som følge av feil bruk, feil installasjon eller ignorerte nasjonale sikkerhetsforskrifter eller andre nasjonale bestemmelser.
- Advarsel: Unnlatelse av å følge installasjonsinstruksjonene kan resultere i skade på produktet og føre til alvorlige eller dødelige personskader.

(POL) POUCZENIE
- Produkt powinien zostać zainstalowany przez wykwalifikowaną osobę, posiadającą stosowne doświadczenie i wiedzę w zakresie zasad bezpieczeństwa oraz instalacji sprzętu elektrycznego. O ile miejscowe przepisy zawierają postanowienia dotyczące wymogu posiadania doświadczenia, bądź niezbędnej wiedzy w zakresie instalacji urządzeń elektrycznych, postanowienia te powinny zostać wypełnione przez wspomnianą powyżej osobę.
- Ensto nie ponosi żadnej odpowiedzialności za niewłaściwe korzystanie, nieprawidłową instalację lub naruszenie regulacji krajowych dotyczących bezpieczeństwa, bądź innych krajowych przepisów prawnych;
- OSTRZEŻENIE : wykonanie instalacji w sposób niezgodny z instrukcją może skutkować uszkodzeniem produktu i poważnymi lub śmiertelnymi obrażeniami ciała.

(POR) AVISO LEGAL
- Este acessório só deverá ser instalado por pessoal especializado, com suficiente formação neste tipo de trabalho, familiarizado com equipamentos eléctricos e aplicação das regras de segurança. Se a legislação local exigir formação ou treino adicional, é da responsabilidade do operador cumprir esses requisitos.
- A Ensto e a RESUL não assumem responsabilidades relativas a reclamações originadas por mau uso, instalação incorrecta ou desconhecimento de regulamentos de segurança ou outra legislação.
- AVISO: A falha em seguir as instruções de montagem pode resultar em danos no acessório e ferimentos graves ou fatais.

(RON) AVIZ JURIDIC
- Produsul trebuie instalat numai de către o persoană competentă, cu pregătire suficientă în practicile de instalare şi cu cunoştinţe suficiente de bune in practici de siguranţă şi de instalare în ceea ce priveşte echipamentele electrice. În cazul în care legislaţia locală conţine dispoziţii cu privire la o astfel de formare sau cunoştinţe suficiente în ceea ce priveşte instalarea de echipamente electrice, aceste dispoziţii vor fi îndeplinite de către persoana respectivă.
- Ensto nu îşi asumă nici o responsabilitate în ceea ce priveşte reclamaţiile rezultate din utilizarea necorespunzătoare, instalarea incorectă sau ignorarea reglementărilor naţionale de siguranţă sau a altor dispoziţii naţionale.
- AVERTIZARE: Nerespectarea instrucţiunilor de instalare poate duce la deteriorarea produsului şi accidente grave sau mortale.

(RUS) ПРАВОВОЕ УВЕДОМЛЕНИЕ
- Изделие должно быть установлено только компетентным человеком, имеющим соответствующую профессиональную подготовку и знающим технику безопасности. Если местное законодательство требует сдачи соответствующих нормативов и прохождения курсов подготовки для допуска к работе, то эти условия должны подлежать обязательному персональному выполнению.
- Ensto не несет ответственность за последствия при неправильном использовании, установке или игнорировании правил техники безопасности или других местных положений.
- ПРЕДУПРЕЖДЕНИЕ: Несоблюдение инструкций по установке может привести к повреждению изделия и к серьезной или даже фатальной травме.

(SLK) PRÁVNA STRÁNKA MONTÁŽE
- Montáž výrobku smie vykonávať len kompetentná osoba s adekvátnym tréningom, praxou a s dostatočnými znalosťami bezpečnosti práce vzhľadom k príslušnému vybaveniu elektrického zariadenia a priestorom. Ak miestna legislatíva obsahuje nariadenie takých tréningov alebo požiadaviek na dostatočné vedomosti s ohľadom na inštalácie týkajúci sa elektrického zariadenia, tak tieto opatrenia budú vykonávané u tejto osoby.
- ENSTO neakceptuje žiadnu zodpovednosť týkajúcej sa nárokov vyplývajúcich z nesprávneho použitia, nesprávnej montáže alebo ignorovania národných bezpečnostných pravidiel alebo iných národných nariadení.
- UPOZORNĚNÍ: Nedodržanie postupu montážneho návodu môže mať za následok poškodenia výrobku alebo i vážne zranenia.

(SLV) PRAVNO OBVESTILO
- Proizvod lahko vgradi le strokovno usposobljena in pooblaščena oseba z zadostnim znanjem v procesih vgradnje, varstvu pri delu in montaži električne opreme. Če lokalna zakonodaja vsebuje določbe v zvezi s takšnim usposabljanjem in zadostnim znanjem vgradnje električne opreme morajo biti te določbe izpolnjene s strani omenjene osebe.
- Podjetje Ensto ne prevzema nobenih odgovornosti v zvezi z zahtevki, ki so posledica napačne uporabe, nepravilne vgradnje ali zanemarjanja nacionalnih varnostnih predpisov in drugih določb.
- OPOZORILO: Neupoštevanje navodil za namestitev lahko povzroči poškodbe izdelka in posledično nevarnost resnih telesnih ali smrtnih poškodb.

(SPA) AVISOS LEGALES
- El producto debe ser instalado sólo por una persona competente con capacitación suficiente en prácticas de instalación y con conocimiento suficiente de las normativas de seguridad adecuadas con respecto al equipamiento eléctrico. Si la legislación local contiene disposiciones con respecto a dicha capacitación o conocimiento suficiente con respecto a la instalación del equipo eléctrico dicha persona deberá cumplir con tales disposiciones.
- Ensto no acepta ninguna responsabilidad con respecto a los reclamos que resultan del uso indebido, instalación incorrecta o regulaciones de seguridad nacional ignoradas u otras disposiciones nacionales.
- ADVERTENCIA: No seguir las instrucciones de instalación podría resultar en un daño al producto y lesión grave o fatal.

(SWE) VIKTIG INFORMATION
- Denna produkt får endast installeras av person med erforderlig kunskap och utbildning avseende installationsarbete och säkerhets- och installationsfrågor beträffande elektrisk utrustning. Om tillämplig lagstiftning eller gällande föreskrifter innehåller bestämmelser eller rekommendationer beträffande sådan kunskap och utbildning eller behörighetskrav med avseende på installation av elektrisk utrustning skall vad som härvid föreskrivs tillämpas med avseende på den som utför installationen. Vid tveksamhet om vad som gäller kontrollera med fackkunskap.
- Ensto friskriver sig från allt ansvar beträffande krav i anledning av felaktig användning eller felaktig installation av produkten eller underlåtenhet att iaktta lokala säkerhetsföreskrifter eller andra tillämpliga bestämmelser eller rekommendationer.
- VARNING: underlåtenhet att följa instruktionerna avseende installation kan resultera i skada på produkten och även allvarlig skada på person eller dödsfall.

ENSTO FINLAND OY ENSIO MIETTISEN KATU 2, P.O.BOX 77 06101 PORVOO, FINLAND TEL. +358 204 76 21 EMAIL: ENSTO@ENSTO.COM WWW.ENSTO.COM

Ensto Phase Balancer
Modbus RTU specifications

Product:	PB50A-3P-200ADV
	Modbus RTU specifications

Change history:

Version	Date	Valid SW*	Major changes	Author
1.0	12.10.2021	1.5	First version	Esa Väkeväinen

**this specification is valid only, if the product has SW of 1.5 or greater.*

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1. Abstract

1.1 Purpose

This document specifies Modbus RTU protocol supported over the serial port interface by the PBD product. This document provides information necessary to read/write from/to the device.

1.2 Definition, Terminology and Abbreviations

Abbreviation / Concept	Definition	Reference
Modbus RTU	Modbus is a data communications protocol originally published by Modicon	
Modicon address	Address convention used in Modbus communication.	
Physical address	It is a word-address to be included in the communication	
Epoch time	It is the number of seconds that have elapsed since the *Unix epoch*, minus leap seconds; the Unix epoch is 00:00:00 UTC on 1 January 1970 (an arbitrary date);	

2. Unit Specification

2.1 Unit Feature(s)

These functions of Modbus RTU are available:

- Reading of multiple input registers (0x04)
- Writing of multiple holding registers (0x10)

2.1.1 Function 04h: Read Input Registers

This function code is used to read the contents of a contiguous block of input registers.

Request frame

Name	Length	Value	Note
Slave address	1 byte	0x01 to 0xF0 (1..240)	
Function code	1 byte	0x04 (4)	
Starting address	2 bytes	0x0000 to 0x02FF (0..767)	Byte order: MSB, LSB
Quantity of registers (N words)	2 bytes	0x01 to 0x0F (1 to 15)	Byte order: MSB, LSB
Cyclic redundancy check	2 bytes		

Response frame of succeeded operation

Name	Length	Value	Note
Slave address	1 byte	0x01 to 0xF0 (1..240)	
Function code	1 byte	0x04 (4)	
Quantity of requested bytes	1 byte	N word * 2	
Register value	N * 2 bytes		Byte order: MSB, LSB
Cyclic redundancy check	2 bytes		

Response frame of failed operation

Name	Length	Value	Note
Slave address	1 byte	0x01 to 0xF0 (1..240)	
Function code	1 byte	0x84 (132)	
Exception code	1 byte	0x01, 0x02, 0x03, 0x04, 0x05	0x01 Illegal function 0x02 Illegal data address 0x03 Illegal data value 0x04 Slave device failure 0x05 Slave device busy
Cyclic redundancy check	2 bytes		

if the device encounters unexpected errors, it discards a request with or without response.

2.1.2 Function 10h: Write Holding Registers

This function code is used to write a multiple holding registers.

Request frame

Name	Length	Value	Note
Slave address	1 byte	0x01 to 0xF0 (1..240)	
Function code	1 byte	0x10 (16)	
Starting address	2 bytes	0x0000 to 0x02FF (0..767)	Byte order: MSB, LSB
Quantity of registers to write (N words)	2 bytes	0x01 to 0x16 (1 to 22)	Byte order: MSB, LSB
Data bytes to follow	1 byte	N * 2 bytes	
Cyclic redundancy check	2 bytes		

Response frame of succeeded operation

Name	Length	Value	Note
Slave address	1 byte	0x01 to 0xF0 (1..240)	
Function code	1 byte	0x10 (16)	
Starting address	2 bytes	0x0000 to 0x02FF (0..767)	
Number of registers written	2 bytes	0x0000 to 0xFFFF (0..65535)	Byte order: MSB, LSB
Cyclic redundancy check	2 bytes		

Response frame of failed operation

Name	Length	Value	Note
Slave address	1 byte	0x01 to 0xF0 (1..240)	
Function code	1 byte	0x90 (144)	
Exception code	1 byte	0x01, 0x02, 0x03, 0x04, 0x05	01 Illegal function 02 Illegal data address 03 Illegal data value 04 Slave device failure 05 Slave device busy
Cyclic redundancy check	2 bytes		

2.1.3 Time synchronization

Faults are timestamped using Epoch time, which is calculated as follows:

$$time = offset + counter$$

where

- *offset is number of* seconds given by master,
- *counter is number of seconds elapsed* since device being started.

If *offset is not set, the device returns only a counter.*

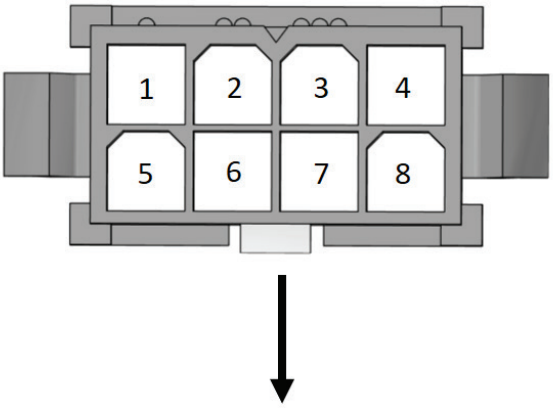
2.2 Connection/Pinout

The device provides communication support of Modbus RTU over RS232 serial port with following settings.

Parameter	Value
Baud rate	9600
Data bits	8 bits
Parity	None
Stop	1 bit
Flow control	None

Figure 1. Serial port settings

Connection terminal and pinout for customer.

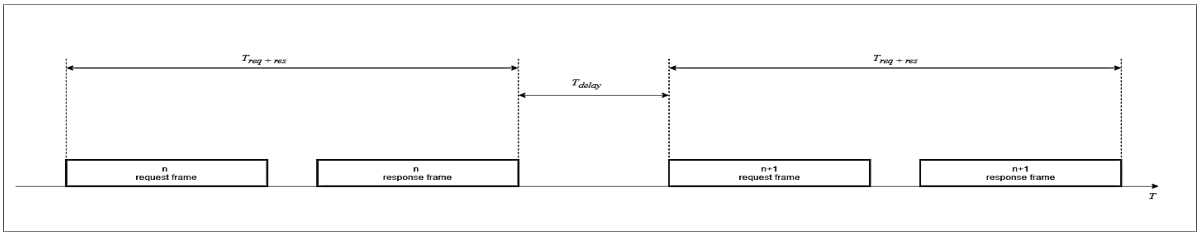


PINOUT

Pin number	Function
3	RX (balancer's serial receiver)
7	TX (balancer's serial transmitter)
2, 4	GND (balancer's ground reference)
8	+24 Vdc output (max current is 1A).

WARNING: Pins 1, 5 and 6 are not allowed to be used by customer nor connected to any potential. Misuse may lead to device failure or malfunction!

2.3 Modbus RTU Timing



The device will send a response immediately after received a request. T_{delay} is 8000 ms of minimum time before the device will accept new query. If device receives a request during $T_{delay,}$ it will discard a request without response.

3. Data Address

3.1.1 Data format representation

The variables are represented by unsigned byte or unsigned integers. Notations described as follows:

Format	IEC data type	Description	Bits	Range
UINT16	UINT	Unsigned integer	16	0x0000 – 0xFFFF (65 535)
UINT32	DINT	Unsigned double integer	32	0x00000000 – 0xFFFFFFFF (4 294 967 295)

3.1.2 Variables and meters

<table>
<tr><th>FUNC</th><th>Address</th><th>Length (words)</th><th>Variable (Unit)</th><th>Data format</th><th>Notes</th></tr>
<tr><td>04h</td><td>0x00</td><td>1</td><td>L1 (V)</td><td>UINT16</td><td></td></tr>
<tr><td>04h</td><td>0x01</td><td>1</td><td>L2 (V)</td><td>UINT16</td><td></td></tr>
<tr><td>04h</td><td>0x02</td><td>1</td><td>L3 (V)</td><td>UINT16</td><td></td></tr>
<tr><td>04h</td><td>0x03</td><td>1</td><td>Neutral current (A)</td><td>UINT16</td><td></td></tr>
<tr><td>04h</td><td>0x04</td><td>1</td><td>Contactor status (ON/OFF)</td><td>UINT16</td><td>1 = closed
0 = open</td></tr>
<tr><td>04h</td><td>0x05 – 0x06</td><td>2</td><td>Elapsed seconds since device being powered up</td><td>UINT32</td><td>seconds</td></tr>
<tr><td>04h</td><td>0x07</td><td>1</td><td>First occurred critical fault indication</td><td>UINT16</td><td>First occurred critical fault, from which the device enters to recovery mode.
<table>
<tr><th>Fault</th><th>Type</th><th>Code</th></tr>
<tr><td>Network</td><td>Critical</td><td>0x01</td></tr>
<tr><td>Contactor</td><td>Critical</td><td>0x02</td></tr>
<tr><td>Gateway</td><td>Non-critical</td><td>0x04</td></tr>
<tr><td>Temperature</td><td>Critical</td><td>0x08</td></tr>
<tr><td>Internal Error</td><td>Non-critical</td><td>0x10</td></tr>
<tr><td>Critical Internal Error</td><td>Critical</td><td>0x20</td></tr>
</table></td></tr>
<tr><td>04h</td><td>0x08-0x09</td><td>2</td><td>Timestamp of first occurred critical fault (seconds)</td><td>UINT32</td><td>Byte order: MSB, LSB
refer to 2.1.3 for more details</td></tr>
<tr><td>04h</td><td>0x0A</td><td>1</td><td>Neutral current fault</td><td>UINT16</td><td>0 = no fault, other = fault occurred</td></tr>
<tr><td>04h</td><td>0x0B</td><td>1</td><td>L1 fault</td><td>UINT16</td><td>0 = no fault, other = fault occurred</td></tr>
<tr><td>04h</td><td>0x0C</td><td>1</td><td>L2 fault</td><td>UINT16</td><td>0 = no fault, other = fault occurred</td></tr>
<tr><td>04h</td><td>0x0D</td><td>1</td><td>L3 fault</td><td>UINT16</td><td>0 = no fault, other = fault occurred</td></tr>
<tr><td>04h</td><td>0x0E</td><td>1</td><td>Contactor error</td><td>UINT16</td><td>0 = no fault, other = fault occurred
<table>
<tr><th>Fault</th><th>Code</th></tr>
<tr><td>Contactor wrong state detected. It should be open.</td><td>0x01</td></tr>
<tr><td>Contactor wrong state detected. It should be close.</td><td>0x02</td></tr>
<tr><td>Missing Phase Voltage</td><td>0x04</td></tr>
<tr><td>Balancing error</td><td>0x08</td></tr>
</table></td></tr>
</table>

<table>
<tr><td>04h</td><td>0x0F</td><td>1</td><td>Communication error</td><td>UINT16</td><td>0 = no fault, other = fault occurred

<table><tr><th>Fault</th><th>Code</th></tr><tr><td>Gateway power supply not shutting down</td><td>0x01</td></tr><tr><td>Power supply protection error</td><td>0x02</td></tr><tr><td>Transmit error</td><td>0x04</td></tr><tr><td>Receive error</td><td>0x08</td></tr></table></td></tr>
<tr><td>04h</td><td>0x10</td><td>1</td><td>Temperature error</td><td>UINT16</td><td>0 = no fault, other = fault occurred

<table><tr><th>Fault</th><th>Code</th></tr><tr><td>Transformer over temperature</td><td>0x01</td></tr><tr><td>Transformer’s sensor error</td><td>0x02</td></tr><tr><td>Transformer over temperature warning</td><td>0x04</td></tr><tr><td>Transformer over temperature alarm</td><td>0x08</td></tr><tr><td>Control board over tempera-ture</td><td>0x10</td></tr><tr><td>Internal overtemperature</td><td>0x20</td></tr></table></td></tr>
<tr><td>04h</td><td>0x11</td><td>1</td><td>Internal error</td><td>UINT16</td><td>0 = no fault, other = fault occurred</td></tr>
<tr><td>04h</td><td>0x12</td><td>1</td><td>Critical Internal Error</td><td>UINT16</td><td>0 = no fault, other = fault occurred</td></tr>
</table>

Example 1: Single address request

Request

This command is requesting the content of input registers of 0x00 (#30001).

```
01 04 00 00 00 01 31 CA
```

```
01       Slave Id
04       Function code 0x04
00 00    Data address of the first register (Modicon address: #30001 + 00 = #30001)
00 01    Total number of registers requested
31 CA    CRC (cyclic redundancy check)
```

Response

```
01 04 01 00 E7 09 7A
```

```
01       Slave Id
04       Function code 0x04
02       Number of bytes to follow (2 bytes from address #30001)
00 E7    Content of address 0x00 (#40001)
09 7A    CRC (cyclic redundancy check)
```

Example 2: Multiple addresses request

Request

This command is requesting the content of input registers from 0x00 – 0x04 (#30001 - #30005).

```
01 04 00 00 00 05 30 09
```

```
01       Slave Id
04       Function code 0x04
00 00    Data address of the first register (Modicon address: #30001 + 01 = #30001)
00 05    1.  Total number of registers requested ( 5 registers from 0x00 – 0x04,
             #30001- #30005)
30 09    CRC (cyclic redundancy check)
```

Response

```
01 04 0A 00 E7 00 E8 00 E9 00 E6 00 01 2B 67
```

```
01       Slave Id
04       Function code 0x04
0A       Number of bytes to follow (2 bytes x 5 from address #30001 - #30005)
00 E7    Content of address 0x00 (#30001)
00 E8    Content of address 0x01 (#30002)
00 E9    Content of address 0x02 (#30003)
00 E6    Content of address 0x03 (#30004)
00 01    Content of address 0x04 (#30005)
2B 67    CRC (cyclic redundancy check)
```

3.1.3 Error logs

FUNC	Address	Length (words)	Variable (Unit)	Data format	Notes
04h	0x20	1	1st critical fault record	UINT16	**) *fault types*
04h	0x21 0x22	2	1st critical fault record timestamp	UINT32	Byte order: MSB, LSB refer to 2.1.3 for more details
04h	0x23	1	2nd critical fault record	UINT16	**) *fault types*
04h	0x24 0x25	2	2nd critical fault record timestamp	UINT32	Byte order: MSB, LSB refer to 2.1.3 for more details
04h	0x26	1	3rd critical fault record	UINT16	**) *fault types*
04h	0x27 0x28	2	3rd critical fault record timestamp	UINT32	Byte order: MSB, LSB refer to 2.1.3 for more details
04h	0x29	1	4th critical fault record	UINT16	**) *fault types*
04h	0x2A 0x2B	2	4th critical fault record timestamp	UINT32	Byte order: MSB, LSB refer to 2.1.3 for more details
04h	0x2C	1	5th critical fault record	UINT16	**) *fault types*
04h	0x2D 0x2E	2	5th critical fault record timestamp	UINT32	Byte order: MSB, LSB refer to 2.1.3 for more details

04h	0x2F	1	6th critical fault record	UINT16	**) *fault types*
04h	0x30 0x31	2	6th critical fault record timestamp	UINT32	Byte order: MSB, LSB refer to 2.1.3 for more details
04h	0x32	1	7th critical fault record	UINT16	**) *fault types*
04h	0x33 0x34	2	7th critical fault record timestamp	UINT32	Byte order: MSB, LSB refer to 2.1.3 for more details
04h	0x35	1	8th critical fault record	UINT16	**) *fault types*
04h	0x36 0x37	2	8th critical fault record timestamp	UINT32	Byte order: MSB, LSB refer to 2.1.3 for more details
04h	0x38	1	9th critical fault record	UINT16	**) *fault types*
04h	0x39 0x3A	2	9th critical fault record timestamp	UINT32	Byte order: MSB, LSB refer to 2.1.3 for more details
04h	0x3B	1	10th critical fault record	UINT16	**) *fault types*
04h	0x3C 0x3D	2	10th critical fault record timestamp	UINT32	Byte order: MSB, LSB refer to 2.1.3 for more details
04h	0x3E	1	11th critical fault record	UINT16	**) *fault types*
04h	0x3F 0x40	2	11th critical fault record timestamp	UINT32	Byte order: MSB, LSB refer to 2.1.3 for more details
04h	0x40	1	12th critical fault record	UINT16	**) *fault types*
04h	0x42 0x43	2	12th critical fault record timestamp	UINT32	Byte order: MSB, LSB refer to 2.1.3 for more details
04h	0x44	1	13th critical fault record	UINT16	**) *fault types*
04h	0x45 0x46	2	13th critical fault record timestamp	UINT32	Byte order: MSB, LSB refer to 2.1.3 for more details
04h	0x47	1	14th critical fault record	UINT16	**) *fault types*
04h	0x48 0x49	2	14th critical fault record timestamp	UINT32	Byte order: MSB, LSB refer to 2.1.3 for more details
04h	0x4A	1	15th critical fault record	UINT16	**) *fault types*
04h	0x4B 0x4C	2	15th critical fault record timestamp	UINT32	Byte order: MSB, LSB refer to 2.1.3 for more details

****) Fault types are defined in following table**

Fault	Type	Code
Network	Critical	0x01
Contactor	Critical	0x02
Gateway	Non-critical	0x04
Temperature	Critical	0x08
Internal error	Non-critical	0x10
Critical Internal error	Critical	0x20

Example: Multiple faults request

Request

This command is requesting the content of input registers from 0x20 – 0x2F (#30033 - #30047).

```
01 04 00 20 00 0F B1 C4
```

```
01       Slave Id
04       Function code 0x04
00 20    Data address of the first register (Modicon address: #30001 + 0x20 = #30033)
00 0F    Total number of registers requested (15 registers from 0x20 - 0x2F, #30033 -
         #30047)
B1 C4    CRC (cyclic redundancy check)
```

3.1.4 Firmware version

FUNC	Address	Length (words)	Variable (Unit)	Data format	Notes
4h	0x14	1	FW major version	UINT16	
4h	0x15	1	FW minor version	UINT16	

Example: Request firmware version

Request

This command is requesting the content of input registers of 14h (#30021).

```
01 04 00 14 00 02 31 CF
```

```
01       Slave Id
04       Function code 0x04
00 14    Data address of the first register (Modicon address: #30001 + 0x14 = #30021)
00 02    Total number of registers requested
31 CF    CRC (cyclic redundancy check)
```

Response

```
01 04 04 00 01 00 05 AB 87
```

```
01       Slave Id
04       Function code 0x04
04       Number of bytes to follow (2 bytes x 2 registers from address #30021 -
         #30022)
00 01    Content of address 0x14 (#30021)
00 05    Content of address 0x15 (#30022)
AB 87    CRC (cyclic redundancy check)
```

3.1.5 Identification code / Serial Number

FUNC	Address	Length (words)	Unit	Data format	Notes
4h	0x16	1	Letter 1 Letter 2	UINT16	MSB:ASCII code LSB: ASCII code
4h	0x17	1	Letter 3 Letter 4	UINT16	MSB:ASCII code LSB: ASCII code
4h	0x18	1	Letter 5 Letter 6	UINT16	MSB:ASCII code LSB: ASCII code
4h	0x19	1	Letter 7 Letter 8	UINT16	MSB:ASCII code LSB: ASCII code
4h	0x1A	1	Letter 9 Letter 10	UINT16	MSB:ASCII code LSB: ASCII code

4h	0x1B	1	Letter 11 Letter 12	UINT16	MSB:ASCII code LSB: ASCII code
4h	0x1C	1	Letter 13 Letter 14	UINT16	MSB:ASCII code LSB: ASCII code
4h	0x1D	1	Letter 15 Letter 16	UINT16	MSB:ASCII code LSB: ASCII code

Example: Request identification code / Serial Number

Request

This command is requesting the content of input registers of 16h (#30023).

```
01 04 00 16 00 08 10 08
```

```
01       Slave Id
04       Function code 0x04
00 16    Data address of the first register (Modicon address: #30001 + 0x16 = #30023)
00 08    Total number of registers requested (8)
10 08    CRC (cyclic redundancy check)
```

Response

```
01 04 10 61 62 63 64 65 66 67 68 31 32 33 34 35 36 37 38 3E 65
```

```
01       Slave Id
04       Function code 0x04
10       Number of bytes to follow (2 bytes x 8 registers from address #30023 -
         #30030)
61 62    Content of address 0x16 (#30023)
63 64    Content of address 0x17 (#30024)
65 66    Content of address 0x18 (#30025)
67 68    Content of address 0x19 (#30026)
31 32    Content of address 0x1A (#30027)
33 34    Content of address 0x1B (#30028)
35 36    Content of address 0x1C (#30029)
37 38    Content of address 0x1D (#30030)
3E 65    CRC (cyclic redundancy check)
```

4. Programming parameter

4.1 Time synchronization

FUNC	Address	Length (words)	Unit	Data format	Notes
10h	2C4h	1	Timestamp offset	UINT16	MSB Refer to 2.1.3 for more details.
10h	2C5h	1	Timestamp offset	UINT16	LSB Refer to 2.1.3 for more details.

Example: Set offset to timestamp

Request

This command is write value "112077002" (06AE28CAh) to holding registers from 2C4h – 2C5h (#30709 – #30710).

```
01 10 02 C4 00 02 04 06 AE 28 CA 18 52
```

```
01       Slave Id
10       Function code 0x10 (16)
02 C4    Data address of first register (Modicon address #30001 + 0x2C4 = #30709)
00 02    Number of registers to write (2)
04       Data bytes to follow (4)
06 AE    Content to write to address 0x2C4 (#30709)
28 CA    Content to write to address 0x2C5 (#30710)
18 52    CRC (cyclic redundancy check)
```

Response

```
01 10 02 C4 00 02 16 AC
```

```
01       Slave Id
10       Function code 0x10 (16)
02 C4    Data address of first register
00 02    Number of registers written
16 AC    CRC (cyclic redundancy check)
```

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