

## P4600

### UTILITY AND INDUSTRIAL BATTERY CHARGERS



## ABOUT US:

Trystar is a dedicated team of professionals providing high quality AC and DC backup systems for utilities, power generation, oil & gas, industrial applications and wherever a true industrial quality backup system is required. Trystar has always focused on developing engineered solutions to enhance the quality and the availability of backup power while giving the necessary tools to reduce costs and streamline operations.

## P4600 Series

Trystar P4600 series is the evolution of our microprocessor controlled rectifier. Its advanced features allow communication, battery monitoring and maintenance fingertips. automation at your The P4600 user friendly touch-screen gives access to all functions and options on a visually interactive screen. Optional communication provides the ability to remotely and securely interact with all of the system parameters and set-up features including our unique battery monitoring and maintenance capabilities. The P4600 series is designed to provide up to 750VDC and 3000A in single phase or 3 phase; and 6, 12 or 18 pulse configurations with or without THD filter. The P4600 series is engineered to comply with UL-CSA-IEC-NEMA-ABS standards.

## Why Trystar:

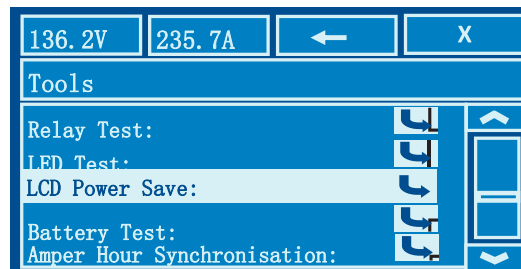
In today's operational world the basic battery charger can no longer keep up with modern demands of communication, monitoring and maintenance automation.

At Trystar, we offer integrated solutions giving the user unparalleled flexibility to upgrades and ease of deployment for your present and future growth.

## Communicate

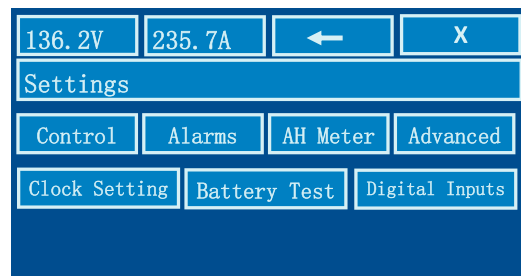
The reliable Trystar P4600 offers protection, communication and maintenance automation features that will ensure that your battery backup system will protect the high value assets in your substation. The P4600 battery monitoring and maintenance features will help insure backup availability and reliability of power from your battery while significantly reducing your maintenance expenditure. Opting for these tools can improve the net value of your system and reduce costly maintenance visits and unexpected shutdowns.

## Protect Automate



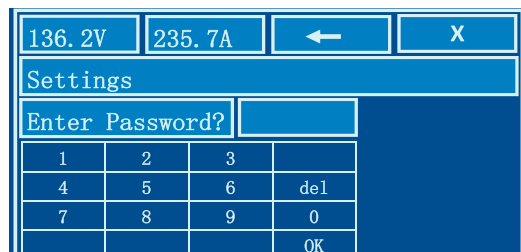
## EASE OF USE

Adjust, reset and test all alarms and options through the scroll down menu



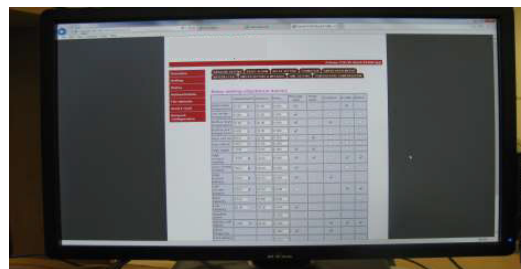
## USER FRIENDLY

Advanced Digital Inputs Access your settings through a user friendly touch screen



## ACCESS

Your critical settings are protected by multi-level passwords



## AND MUCH MORE

Diagnostic, Automation, communication and many advanced options are site installable and activated

## OPTIONS

### Interface:

- Individual alarm form “C” contacts
- Modbus RTU via RS232/485 or TCP/IP, DNP3, IEC 61850, Canbus
- Web page via Local or dynamic IP address
- 4-20mA& 0-5V current and voltage R/W loops
- 8 customer defined digital inputs

### Maintenance

- Temperature compensation c/w temperature probe
- Battery imbalance alarm
- Integrated online Battery Test
- Integrated online Battery continuity test
- Battery circuit breaker
- Low volt load disconnect
- Remote equalize
- Remote shutdown
- Battery liquid level monitor

### Alarms

- Buzzer with reset
- Hardware high volt shutdown
- 2nd low volts
- AC High & Low Voltage
- Battery high & low temperature alarm and shutdown
- Charger or battery high temperature derating and shutdown

### Input and Output

- 50Hz input frequency
- 12 or 18 pulse rectification to reduce THD & ripple with balanced current sharing and 1/2 bridge failure alarm.9 Optional derating.
- Power limited bandwidth filter
- THD and P.F. correction filter
- High capacity interrupting breakers
- Connection free forced load sharing
- Remote battery voltage sensing
- DC output circuit breaker
- Dropping diode circuit
- Battery current limit
- Integrated Distribution panel

## 01- PROTECT

Protect your system from premature failures

### Battery

- Open circuit
- Failed cells
- Accelerated aging
- Ripple effect
- High temperature
- Unbalanced charge

### Charger

- Loss of output regulation
- High voltage
- Loss of one phase

## 02- AUTOMATE

- Data logging with date and time stamp
- Routine battery service test
- Automated battery Continuity test
- Battery temperature monitoring
- Battery water level monitoring

## 03- COMMUNICATE

- Password protected
- Read / write communication on all settings
- operational modes, alarms and readings via most popular protocols

## High ripple alarm

Ripple is #1 battery enemy. It micro cycles the battery and cause accelerated aging. One of 3 phase legs may fail due to protection or an SCR failure. Also capacitors age and fail over time then ripple will increase. The P4600 high ripple alarm can help into predicting events where ripple has reached as low as 1% rms.



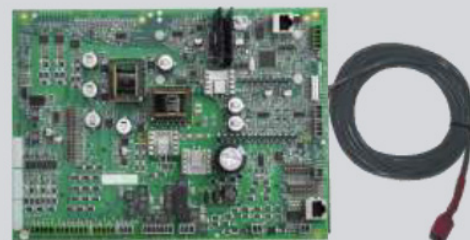
## Read-Write Communication

Substation automation relies on access to each device information in both directions: read and write. The P4600 series offers the following protocols: DNP3, MODBUS & MODBUS over Ethernet Web server with extensive imbedded webpage IEC 61850



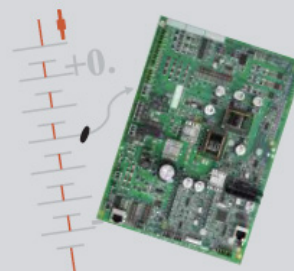
## Temperature compensation

At every 10°C increase leads to half battery life. Compensation of float voltage is needed to optimize battery recharging and to preserve battery life. Opting for this tool will help to reduce the chances of over and under charging the battery thus preventing its premature failure. In addition to compensating float voltage, it also indicates battery temperature on the LCD. Should you wish, the charger may activate a cyclical shutdown if the temperature exceeds recommended limits. exceeds recommended limits.



## Battery imbalance alarm:

Your battery is your last line of defence. Individual cells within a battery are not built equally, they age differently and may fail in different modes: Monitoring the battery's state of health is a must. A simple way to predict battery failure is by using a battery imbalance monitor. It will alarm should one cell drop in voltage lower than the others during float, equalize or even while the battery is discharging.



## Ampere-hour meter

Predicting residual battery capacity in order to estimate backup time at any moment is an essential tool to manage crisis situations. The integrated AH meter will display the actual battery capacity during charging and during discharging modes. The operator will then be capable to safely manage his emergency plan with more confidence.



## Battery Continuity Tester & cell open alarm

Having your battery fail open could have serious consequences. Our automatic tester will periodically test for continuity and report any change that could lead to an open failure. Also, this test will ensure that all your connections are as per specification.

### 2nd low volts alarm

As a backup we include 2 levels of Low volt DC alarm. The 1st alarm can be set at the battery's open circuit voltage to give the first notice while the 2nd alarm can be set at the battery's final voltage to send the most critical level notice.

## Basic design features

UL/ANSI 1012 Listed, CSA C22.2 107.1. Certified to applicable IEC standards<sup>1</sup>, ABS<sup>2</sup>, ISO 9001 Quality control SCR (Thyristor) based rectifier c/w double wound isolation transformer, electronic control, current limiting and voltage regulation modular construction using the latest power and micro-electronic devices, numbered PVC copper stranded wire, 30 year design.

<b>MTBF</b>	300 000 hours typical				
<b>MTTR</b>	less than 1 hour				
<b>Available voltages</b>	110, 120, 208, 220, 240, 277, 380, 400, 460, 480, 550, 575, and 600 VAC				
<b>Phases</b>	1 and 3 phase 60Hz (50Hz optional)				
<b>Power factor</b>	0.75 (1 phase), 0.85 (3 phase) at nominal load when tested on battery and resistive load				
<b>Efficiency</b>	Typical 90% at full load				
<b>Output:</b>					
<b>Standard voltages</b>	12, 24, 36, 48, 72, 110, 130, 250, 380, 480, 600, 750 VDC (nominal)				
<b>Power</b>	From 60 W to 1000+ kW				
<b>AC ripple voltage (RMS)</b>	Level 1 Filter <sup>3</sup>	12-24-48VDC	125VDC	250VDC	>250VDC
	Level 2 Filter <sup>3</sup>	2%, 30mV	2% 100mV	2% 200mV	2% 1%
<b>Static regulation</b>	≤ 0.5% in float for simultaneous variations of +10/-12% input voltage, +/- 5% frequency and 0-100% load				
<b>Dynamic regulation</b>	+/-6% from 10%-90% and 90%-10% load variation (t< 300msec)				
<b>Load sharing</b>	Wireless forced load sharing via droop share control				
<b>Emc<sup>1</sup></b>	EN 61000-6-4: Emission standard for industrial equipment EN61000-6-5: Immunity standard for power/substation equipment EN 61558-1: Safety standard for power supplies and similar devices				
<b>Protection:</b>	Soft start, Automatic current limiting adjustable from 20% to 100% of nominal rating, higher current limits optional Input thermal-magnetic circuit breaker and DC output fuse standard Surge suppression on input and output. Reverse polarity.				

## Standard Features

### Metering & logging. :

- Simultaneous DC voltage and current metering 0.5 % Accuracy  $\pm$  1 digit
- Line frequency monitoring
- Rectifier ambient temperature
- +/- Bus to ground voltage
- Remaining and elapsed equalize time
- Time stamped event log (250 events)

### Control modes:

- Constant Voltage regulation. Limited current
- Forced load sharing without common wire connection
- DC current de-rating based on charger temperature

### Local indications:

- AC On green LED
- Urgent Red LED
- Non-Urgent Amber LED
- Common alarm with flashing LED
- LCD sleep mode

### Charging modes:

- Automatic or manual float / equalize
- Adjustable Float and equalize
- Equalize period 0-88 months (in h)
- Automatic equalize mode activation
- based on: time, low volts, charger start, AC fail, current limit: time adjustable 1-100hrs
- Automatic equalize termination based on voltage, time, or current
- Antidepressant equalize mode
- Constant current mode (formation)

### Remote indications:

Common relay with dry form "C" contacts

Others Restore default

### Alarms:

- Alarm acknowledgement and reset
- LED & relay test and reset

### Default alarms:

- Rectifier failure
- AC fail
- Battery high volt
- Battery low volt
- Positive & negative ground fault in mA or k $\Omega$

### Factory<sup>4</sup> or customer activated alarms:

- End of discharge (2nd low volt level)
- High volts shutdown
- Equalization on
- High ripple
- High/low frequency shutdown
- High/low temperature shutdown
- Rectifier high/low current
- Rectifier high/low volt

Each can be enabled or disabled, has its own level and time delay, its message and relay latched or unlatched, its relay failsafe on or off.

1. *CE marked units only,*
2. *Marine applications only*
3. *Values are typical, measured on resistive load at the charger output terminals as per IEEE 946 & IEEE 2405. Other values are also available on request.*
4. *Must be specified at order time*

## Mechanical dimensions, weight and heat loss

### Standard mechanical specifications

Enclosure NEMA1 (IP20), steel c/w hinged front access door. Standard ANSI 61, light gray Natural convection cooling up to 100A output current Forced air cooling assistance for units with over 100A output current

*Floor mounted models are provided with 3 in. (75mm) clearance at bottom to facilitate handling by lift truck, pallet truck or slings*

### Environmental:

Audible noise 45 to 65 dBa at 3ft (1 meter) rating

Temperature range dependant Operating 32°F to +122°F (0°C to 50°C)/Storage -40°F to 185°F (-40°C to 85°C) Temperature de-rating 0.83% / °F from 122°F to 140°F (1.5% / °C from 50°C to 60°C)

Operating humidity Up to 95% (non condensing)

Altitude range 0% for 1st 3300 ft (1000m), de-rating 7% per 3300 ft (1000m) over 3300 ft (1000m)

## Standard Features

1 PHASE CHARGERS											
P4600-1-24	5	10	15	20	25	30	35	40	50	75	100
EN1	ARM 300	ARM 300	ARM 300	ARM 300	ARM 400	ARM 400	ARM 400	ARM 500	ARM 500	ARM 500	ARM 650
weight	80	85	115	121	136	141	n/a	226	267	333	388
weight kg	36	39	52	55	62	64	n/a	103	121	151	176
KW	0.04	0.06	0.08	0.1	0.12	0.15	n/a	0.2	0.25	0.38	0.5
BTU	119	196	273	350	427	503	n/a	699	853	1280	1706

P4600-1-48	5	10	15	20	25	30	35	40	50	75	100
EN1	ARM 300	ARM 300	ARM 300	ARM 300	ARM 400	ARM 400	ARM 400	ARM 500	ARM 500	ARM 500	ARM 650
weight	85	96	141	161	177	262	n/a	308	338	389	443
weight kg	39	44	64	73	80	119	n/a	140	154	177	201
KW	0.05	0.08	0.12	0.16	0.2	0.24	n/a	0.32	0.39	0.57	0.78
BTU	162	282	401	563	682	802	n/a	1083	1322	1962	2644

P4600-1-125	5	10	15	20	25	30	35	40	50	75	100
EN1	ARM 300	ARM 400	ARM 400	ARM 400	ARM 500	ARM 500	ARM 500	ARM 500	ARM 500	ARM 600	ARM 650
weight	104	172	243	248	322	339	n/a	368	405	531	556
weight kg	47	78	110	113	146	154	n/a	167	184	241	253
KW	0.08	0.16	0.24	0.32	0.4	0.47	n/a	0.63	0.8	1.2	1.6
BTU	290	537	827	1075	1365	1612	n/a	2150	2730	4095	5459

P4600-1-250	5	10	15	20	25	30	35	40	50	75	100
EN1	ARM 400	ARM 400	ARM 500	ARM 500	ARM 500	ARM 650	ARM 650	ARM 650	ARM 650	ARM 700	ARM 750
weight	172	223	339	368	380	506	n/a	506	531	644	828
weight kg	78	101	154	167	173	230	n/a	230	241	293	376
KW	0.15	0.3	0.44	0.59	0.75	0.88	n/a	1.18	1.5	2.25	2.95
BTU	503	1007	1510	2013	2559	3020	n/a	4026	5118	7677	10066

Dimensions			
Inches	H	W	D
ARM 350	30	17	12
ARM 500	39	24	20
ARM 650	51	24	20
ARM 700	60	36	25

Millimeters			
ARM 350	762	432	305
ARM 500	991	610	508
ARM 650	1295	610	508
ARM 700	1524	914	635

3 PHASE CHARGERS																	
P4600-3-24	5	10	15	20	25	30	40	50	75	100	125	150	200	250	300	400	500
EN1	ARM 400	ARM 400	ARM 400	ARM 400	ARM 400	ARM 400	ARM 500	ARM 500	ARM 500	ARM 650	ARM 700	ARM 700	ARM 700	ARM 700	ARM 700	ARM700+TXF	ARM700+TXF
weight	94	101	133	139	143	150	242	287	373	430	441	463	551	617	642	782	807
weight kg	43	46	60	63	65	68	110	130	170	195	200	210	250	280	292	355	367
KW	0.04	0.07	0.1	0.13	0.16	0.18	0.24	0.29	0.43	0.57	0.7	0.84	1.14	1.41	1.68	2.27	2.82
BTU	154	247	341	435	529	623	810	998	1467	1936	2406	2875	3873	4811	5749	7746	9622

P4600-3-48	5	10	15	20	25	30	40	50	75	100	125	150	200	250	300	400	500
EN1	ARM 400	ARM 400	ARM 400	ARM 400	ARM 400	ARM 500	ARM 500	ARM 500	ARM 650	ARM 650	ARM 700	ARM 700	ARM 700	ARM 700	ARM 700	ARM700+TXF	ARM700+TXF
weight	101	114	150	117	197	288	348	380	438	501	517	517	697	747	772	865	1097
weight kg	46	52	68	80	90	131	158	173	199	228	235	235	317	340	351	393	499
KW	0.04	0.09	0.14	0.18	0.22	0.27	0.34	0.43	0.64	0.86	1.09	1.28	1.73	2.18	2.56	3.46	4.29
BTU	154	307	461	614	768	921	1169	1476	2184	2952	3719	4368	5903	7438	8735	11806	14638

P4600-3-125	5	10	15	20	25	30	40	50	75	100	125	150	200	250	300	400	500
EN1	ARM 400	ARM 400	ARM 400	ARM 400	ARM 500	ARM 500	ARM 500	ARM 500	ARM 650	ARM 650	ARM 700	ARM 700	ARM 700	ARM700+TXF	ARM700+TXF	ARM700+TXF	ARM700+TXF
weight	125	198	283	290	366	388	426	467	622	647	730	780	1037	1037	1415	1425	1703
weight kg	57	90	129	132	166	176	194	212	283	294	332	355	471	471	643	648	774
KW	0.1	0.18	0.28	0.36	0.44	0.53	0.71	0.87	1.3	1.74	2.21	2.61	3.48	4.35	5.22	6.96	8.7
BTU	333	606	938	1211	1484	1817	2423	2969	4453	5937	7541	8906	11874	14843	17811	23749	29686

P4600-3-250	5	10	15	20	25	30	40	50	75	100	125	150	200	250	300	400	500
EN1	ARM 400	ARM 400	ARM 500	ARM 500	ARM 500	ARM 650	ARM 650	ARM 650	ARM 700	ARM 700	ARM 700	ARM 700	ARM700+TXF	ARM700+TXF	ARM700+TXF	ARM700+TXF	ARM700+TXF
weight	198	265	388	426	442	597	597	622	755	987	987	1340	1400	1653	1985	1985	2410
weight kg	90	120	176	194	201	271	271	283	343	449	449	609	636	751	902	902	1095
KW	0.17	0.32	0.48	0.64	0.82	0.97	1.27	1.64	2.39	3.21	3.96	4.78	6.35	8.2	9.7	12.7	16.05
BTU	572	1083	1655	2167	2798	3310	4333	5596	8155	10953	13512	16310	21667	27980	33098	43334	54765

**Other sizes are available upon request**

**Reduce your maintenance expenditure- Maximize battery life Increase your system's reliability - Reduce your long term cost of ownership**

---

## LIFELINE™

**What** can go wrong with the battery?

If these events or failures are unavoidable... How can chargers help to prevent some of these failures from occurring?

The *Lifeline* package is designed to help by improving reports, alleviating maintenance burden and most importantly increasing the dc system reliability:

### Included alarms and features:

- Automatic Online Partial Battery Capacity Test
- Automatic Continuity Tester & Battery open alarm
- Second level of low volt dc alarm
- Battery discharging alarm
- High voltage shutdown
- Low current alarm
- Battery temperature compensation with temperature readings
- Battery high temperature alarm & shutdown
- AC high ripple alarm
- Battery imbalance monitor
- Digital charge/discharge/Ah metering
- Watchdog circuits

### Included recording and reporting:

- A data logger (black box)
  - A true read/write communication module that can come in any of the following formats: DNP3, MODBUS & MODBUS over Ethernet, Web server (charger generates its own webpage)
  - Optional IEC 61850
-

Charger with integrated DC distribution panel and battery compartment



12 pulse large charger designed to reduce THDi & ripple



Redundant chargers with common battery compartment





TRYSTAR®