

**PHOTOVOLTAIC ARRAY WIRING**  
**HANDBOOK FOR**  
**STANDARD NOMINAL 6, 12, 24, AND**  
**48 VOLT SYSTEMS**

(for SX-60 series or smaller and MSX-120 solar modules)

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**NOTE**

The information given in this booklet is intended to provide the end installer with the instructions to wire the PV system. It is mandatory that the installer follow all of the state or local codes that apply to the actual PV system.

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<u>DRAWING</u>	<u>TITLE</u>
WKS206***	6V BASIC WIRING SYSTEMS
WKS212***	12V BASIC WIRING SYSTEMS
WKS224***	24V BASIC WIRING SYSTEMS
WKS248***	48V BASIC WIRING SYSTEMS

## 1.0 INTRODUCTION

This handbook is intended for use in the installation of basic (standard) photovoltaic (PV) systems. The primary purpose of the Solarex standard Module PV array is to produce current, at specified nominal voltages, up to a maximum of 20 Amperes. As the Module (SX-60 series) produces up to a nominal 8.0 Amps Short-circuit current ( $I_{sc}$ ) when wired for a nominal 6 volts at Standard Test Conditions (STC) or 4.0 Amps  $I_{sc}$  when wired for a nominal 12 volts, the number of modules required to produce the maximum current for each voltage system is: 6-volts, two modules; 12-volts, five modules; 24-volts, 10 modules; and 48-volts, 20 modules. Larger systems can be provided for specific requirements. The length of cable from the array to the regulator is critical. Too long a cable will cause unacceptable losses in the specified parameters of the array. The same is true for battery and load cables.

NOTE: Standard Test Conditions - Illumination of  $1\text{kW/m}^2$  (1 sun) at spectral distribution of AM 1.5 and cell temperature at  $25^\circ\text{C}$ .

A description of the system wiring concept and terminology is provided along with component descriptions and instructions for wiring a basic 6 volt, 12 volt, 24 volt, or 48 volt system. (See drawings WKS206\*\*\* through WKS248\*\*\*) Personnel installing the system should read this handbook thoroughly before attempting to wire the system.

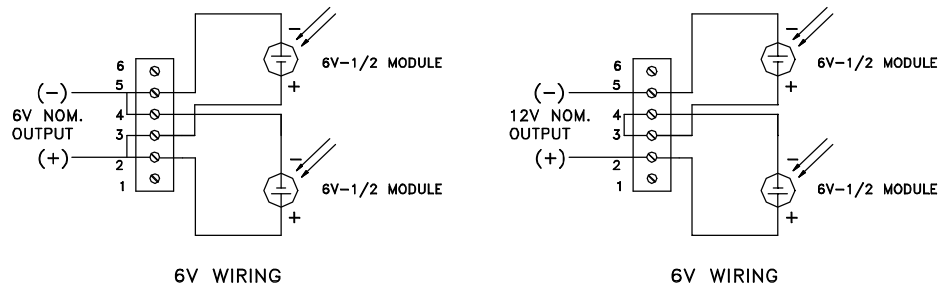
Personnel must study this handbook in detail and have a clear understanding of the system to avoid damage and injury. All applicable local or state codes (such as the National Electric Code (N.E.C.) for the U.S.A.) should be followed in all aspects and should override if different from instructions given in this booklet.

## 2.0 BASIC SYSTEM WIRING PRINCIPLES

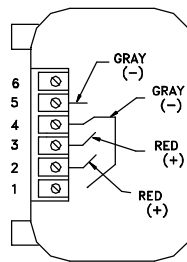
This section discusses the basic wiring principles and defines the wiring terminology, which applies to all Module system nominal voltages (6, 12, 24, and 48). The intent of this section is to provide persons installing the system with a basic understanding of the wiring systems so that the installation procedures can be more easily comprehended.

Each module J-box is wired in series or parallel with connecting modules in accordance with its position in respect to other modules, panels, or the output. A wiring kit is provided for each required inter-module, inter-panel, and output connection as specified. Refer to drawings WKS206\*\*\* through WKS248\*\*\* for detail of parts supplied with each specific system identified by the voltage requirement and number of modules.

**2.1 Module Wiring.** All Solarex standard modules contain two strings of cells, each producing a nominal six volt output. These strings are pre-wired into their respective Junction boxes (J-boxes) at the factory. Positive (red) leads are connected to terminals 2 and 3 of the J-box. Negative (gray) leads are connected to terminals 4 and 5 of the J-box. For 6 volt operation, terminals 2 and 3, and 4 and 5 are jumpered to provide a parallel output. For 12 volt operation, terminals 3 and 4 are jumpered to provide a series output. Module Junction box wiring and a simplified schematic of the module wiring is shown in Figure 1.



## SIMPLIFIED MODULE SCHEMATIC



TERMINAL STRIP NUMBERING

Positions #1 and #6 are not internally connected and are intended to be used for series parallel intermodule/panel connections.

**FIGURE 1. MODULE WIRING**

**2.2 Blocking Diodes.** Because the PV array only produces voltages during daylight hours, blocking diodes are inserted in the circuits to prevent the batteries from discharging through the array during night time hours or anytime that the array is not producing current. Blocking diodes are placed in each module string for nominal 6 volt and 12 volt configurations. One blocking diode is used for each two modules wired in series, for a nominal 24 volt system and one blocking diode is used for each four modules wired in series, for a nominal 48 volt system (refer to Table 1). For SX-60 series and smaller modules, use the following table as a guide for blocking diode selection.

**TABLE 1. BLOCKING DIODES**

SYSTEM VOLTAGE	QUANTITY BLOCKING DIODE	RATING OR EQUIVALENT	SOLAREX PART NO.
6V Nominal	2 Per Module	5A, 40V, SR504	WK2BD-40
12V Nominal	1 Per Module	5A, 40V, SR504	WK2BD-40
24V Nominal	1 Per Series String	5A, 40V, SR-504	WK2BD-40
48V Nominal	1 Per Series String	6A, 400V, MR-754	WK2BD-400
Above 48V. Not to exceed 600V actual	1 Per Series String	6A, 1000V, MR-760	22200004

**2.3 Bypass Diodes.** The actual electrical characteristics of Solarex's Mega Cells are such that there is no need for by-pass diodes in 6, 12, or 24 Volt nominal systems in normal operation. It would however, be recommended to include by-pass diodes in these systems for very specific applications such as directly driven motors that are subject to very high starting torque's. Please contact the factory for information on these types of specific applications. Note that by-pass diodes are mandatory for all systems with more than two modules in series i.e., 36V, 48V, 96V, 120V, etc. One bypass diode is mandatory, wired in parallel, with each 18 cell string (two diodes for 12V, SX-30 through SX-64).

**TABLE 2. BYPASS DIODES**

SYSTEM VOLTAGE	QUANTITY BYPASS DIODE	RATING OR EQUIVALENT	SOLAREX PART NO.
6V, 12V, 24V Nominal	Not Required	N/A	N/A
ABOVE Nominal 24V, NOT to exceed 600V actual	2 Per Module	6A, 400V, MR-754	WK2BPD

**2.4 Intermodule Wiring.** This refers to the connecting wires between modules of a panel. This connection can be either series or parallel. The wire utilized is #10 (6mm<sup>2</sup>) XHHW-2 with black representing the negative polarity and red representing the positive polarity. The white wire represents a conductor used to connect modules together in series.

**2.5 Interpanel Wiring.** This refers to the connecting wires between panels of a subarray. The wire utilized is #10 (6mm<sup>2</sup>) XHHW-2 with black representing the negative polarity and red representing the positive polarity.

**2.6 Output Wiring.** Output wiring refers to the connecting wires from the output module junction box to the system controller/regulator or battery bank.

The output cable may be provided with the system and is cut to specific lengths for optimum operation of the system. The length of cable should be no more than the maximum length allowed. Use of longer cabling or adding cable to that already provided by splicing will cause degraded system operation. However, use of shorter lengths of cable is acceptable. Refer to drawings WKS206\*\*\* through WKS248\*\*\* for the maximum cable lengths allowed in specific systems.

To accommodate the shortest distance for the output, it may be necessary for systems to be lay out with modules rotated 180°, outputs exiting from the left, etc. Attention must be given to keep the wiring scheme consistent with the basic wiring kit.

**2.7 Surge Protection.** A Metal Oxide Varistor (MOV) located on an optional Add-On terminal provides protection against lightning-induced voltage spikes. The Add-On terminals are used optionally on the output wiring for use of cable larger than #10 AWG (6mm<sup>2</sup>) and not larger than #4 AWG (25mm<sup>2</sup>).



## 2.8 Regulator to Battery Cable

The optimum "electrical" distances between the Regulator and the Battery Bank for the stated AWG wire gauges, using single conductor wire (one for positive and one for negative) for different currents are shown in Tables 1 and 2 for all four nominal system voltages (6, 12, 24, and 48 Volts); meters are rounded to  $\pm 0.1\text{m}$ . Distances shown are for single conductor wire only. Total wire required is times two (Positive and Negative).

Recommended optimum **"Not To Exceed"** voltage drops are as follows:

6 Volt Nominal	<b>"0.04V"</b>
12 Volt Nominal	<b>"0.08V"</b>
24 Volt Nominal	<b>"0.16V"</b>
48 Volt Nominal	<b>"0.32V"</b>

**TABLE 3. REGULATOR TO BATTERY CABLE UP TO 30 AMPS AT 75°C**

<u>NOMINAL VOLTAGE</u>	<u>AWG WIRE GAUGE</u>	<u>10 AMP MAXIMUM DISTANCE</u>	<u>20 AMP MAXIMUM DISTANCE</u>	<u>30 AMP MAXIMUM DISTANCE</u>
		Feet(meters)	Feet(meters)	Feet(meters)
6 Volt	#10	NA	NA	NA
	#6	4 (1.2)	2 (0.6)	NA
	#4	6 (1.8)	3 (0.9)	2 (0.6)
12 Volt	#10	3 (0.9)	NA	NA
	#6	8 (2.4)	4 (1.2)	2.5 (0.8)
	#4	12.5 (3.8)	6 (1.8)	4 (1.2)
24 Volt	#10	6 (1.8)	3 (0.9)	2 (0.6)
	#6	16 (4.9)	8 (2.4)	5 (1.5)
	#4	28 (8.5)	12.5 (3.8)	8 (2.4)
48 Volt	#10	12.5 (3.8)	6 (1.8)	4 (1.2)
	#6	32 (9.8)	16 (4.9)	10.5 (3.2)
	#4	50 (15.2)	25 (7.6)	16.5 (5.0)

NOTE: One foot is equal to 0.3048 meters. All wires are copper.

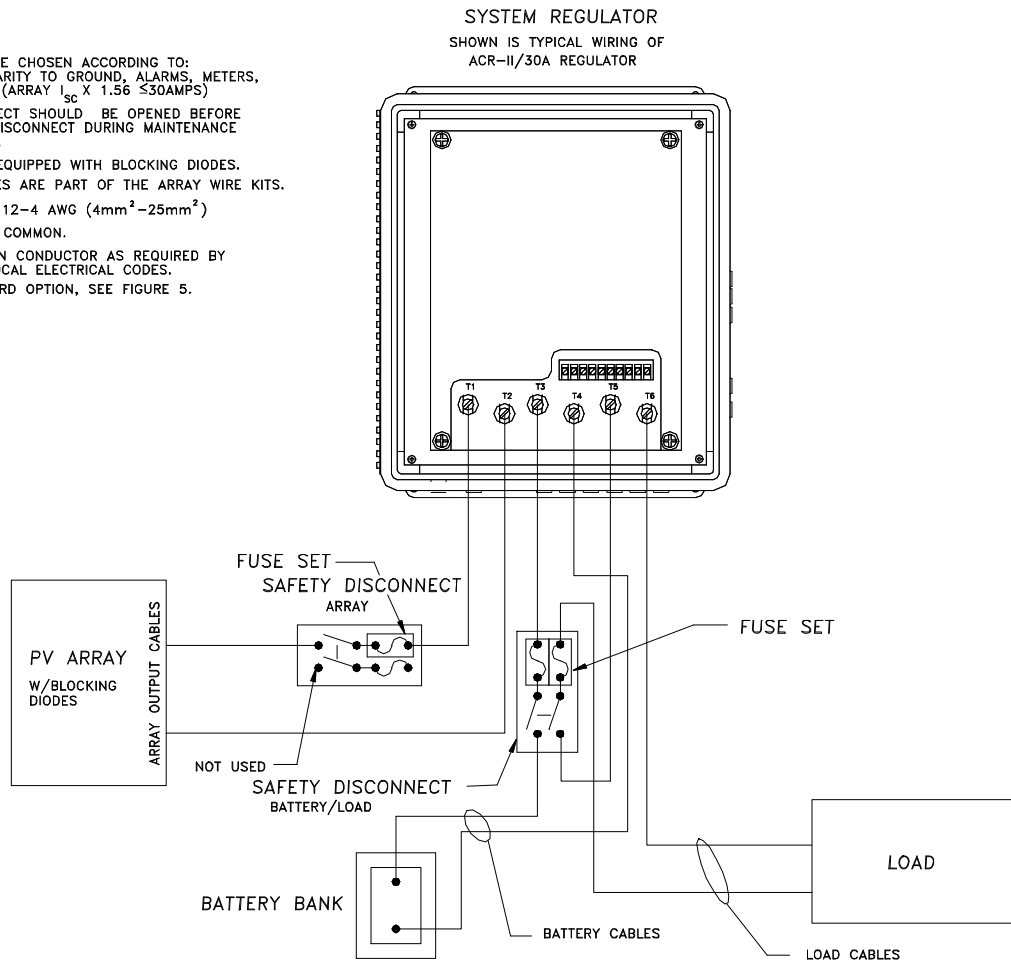
**TABLE 4. REGULATOR TO BATTERY CABLE 30 AMPS TO 200 AMPS AT 75°C**

<u>NOMINAL VOLTAGE</u>	<u>AWG WIRE GAUGE</u>	<u>30 AMP MAXIMUM DISTANCE</u>	<u>60 AMP MAXIMUM DISTANCE</u>	<u>90 AMP MAXIMUM DISTANCE</u>	<u>200 AMP MAXIMUM DISTANCE</u>
		ft. (m)	ft. (m)	ft. (m)	ft. (m)
6 Volt	#2	3.5 (1.1)	NA	NA	NA
	#1/0	5.5 (1.7)	2.5 (0.8)	NA	NA
	#4/0	NA	5 (1.5)	3.5 (1.1)	NA
12 Volt	#2	7 (2.1)	3.5 (1.1)	NA	NA
	#1/0	11 (3.4)	5.5 (1.7)	3.5 (1.1)	NA
	#4/0	NA	11 (3.4)	7 (2.1)	3 (0.9)
	#300MCM	NA	NA	NA	4.5 (1.4)
24 Volt	#2	13 (4.0)	6.5 (2.0)	4.5 (1.4)	NA
	#1/0	21 (6.4)	10.5 (3.2)	7 (2.1)	3 (0.9)
	#4/0	NA	21 (6.4)	14 (4.3)	6.5 (2.0)
	#300MCM	NA	NA	NA	9 (2.7)
48 Volt	#2	27 (8.2)	13.5 (4.1)	9 (2.7)	NA
	#1/0	42 (12.8)	21 (6.4)	14 (4.3)	6 (1.8)
	#4/0	NA	43 (13.1)	29 (8.8)	13 (4.0)
	#300MCM	NA	NA	NA	18 (5.5)

NOTE: One foot is equal to 0.3048 meters. All wires are copper.

**2.9 Typical System Wiring.** Typical system wiring using an ACR-II/30A, an ACR-II/90A, and an ACR-200A are illustrated in Figures 2 thru 4.

- \* ACR-II SHOULD BE CHOSEN ACCORDING TO:  
VOLTAGE, POLARITY TO GROUND, ALARMS, METERS,  
LOAD OUTPUT. (ARRAY  $I_{sc}$  X 1.56  $\leq$  30AMPS)
- \* ARRAY DISCONNECT SHOULD BE OPENED BEFORE  
BATT/LOAD DISCONNECT DURING MAINTENANCE  
OPERATIONS.
- \* ACR-II IS NOT EQUIPPED WITH BLOCKING DIODES.  
BLOCKING DIODES ARE PART OF THE ARRAY WIRE KITS.
- \* WIRE RANGE: # 12-4 AWG (4mm<sup>2</sup>-25mm<sup>2</sup>)
- \* T2, T4, T6 ARE COMMON.
- \* GROUND COMMON CONDUCTOR AS REQUIRED BY  
APPLICABLE LOCAL ELECTRICAL CODES.
- \* FOR ALARM BOARD OPTION, SEE FIGURE 5.



**FIGURE 2. TYPICAL SYSTEM SCHEMATIC WITH AN ACR-II/30A**

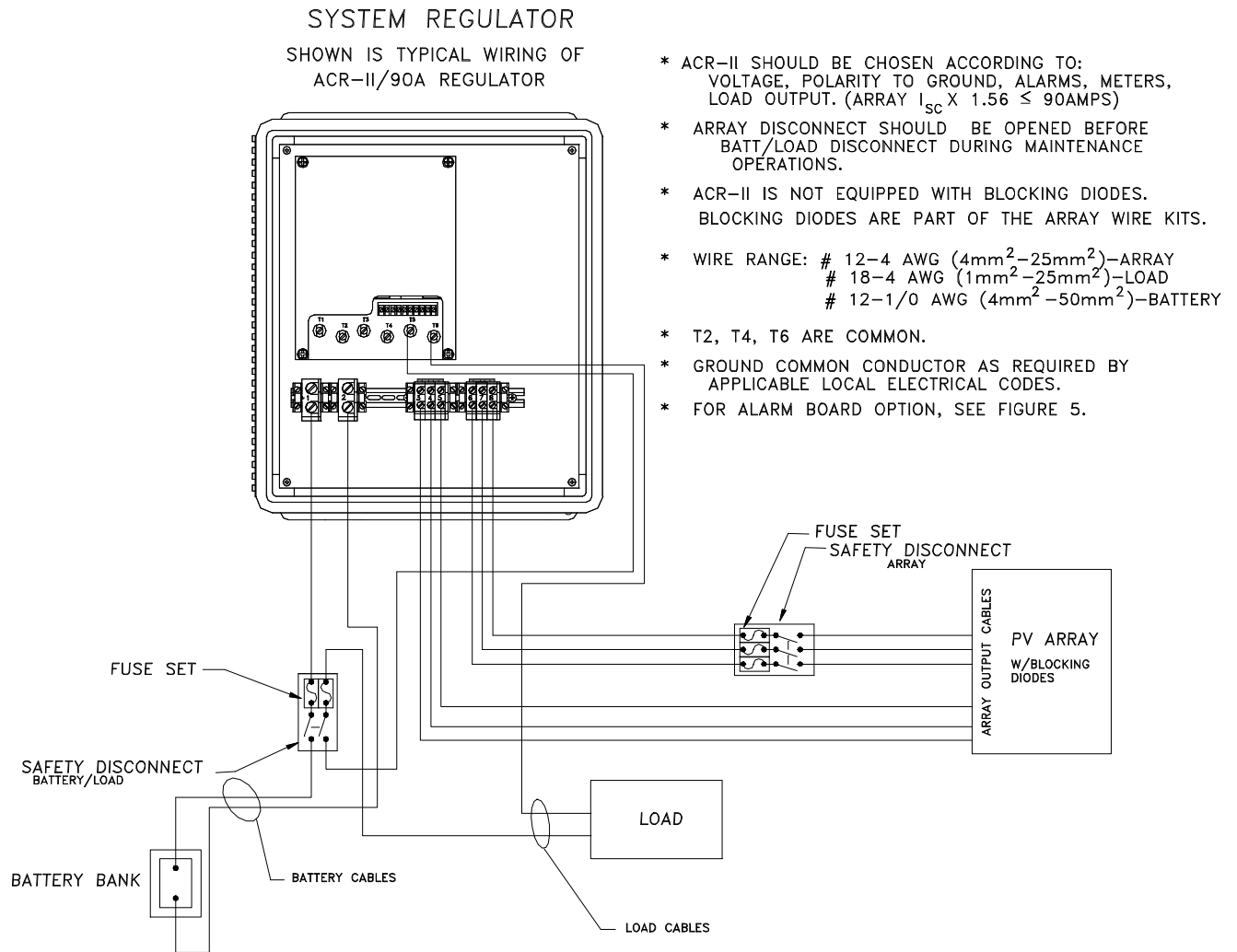


FIGURE 3. TYPICAL SYSTEM SCHEMATIC WITH AN ACR-II/90A

# SYSTEM REGULATOR SHOWN IS TYPICAL WIRING OF ACR-200A REGULATOR

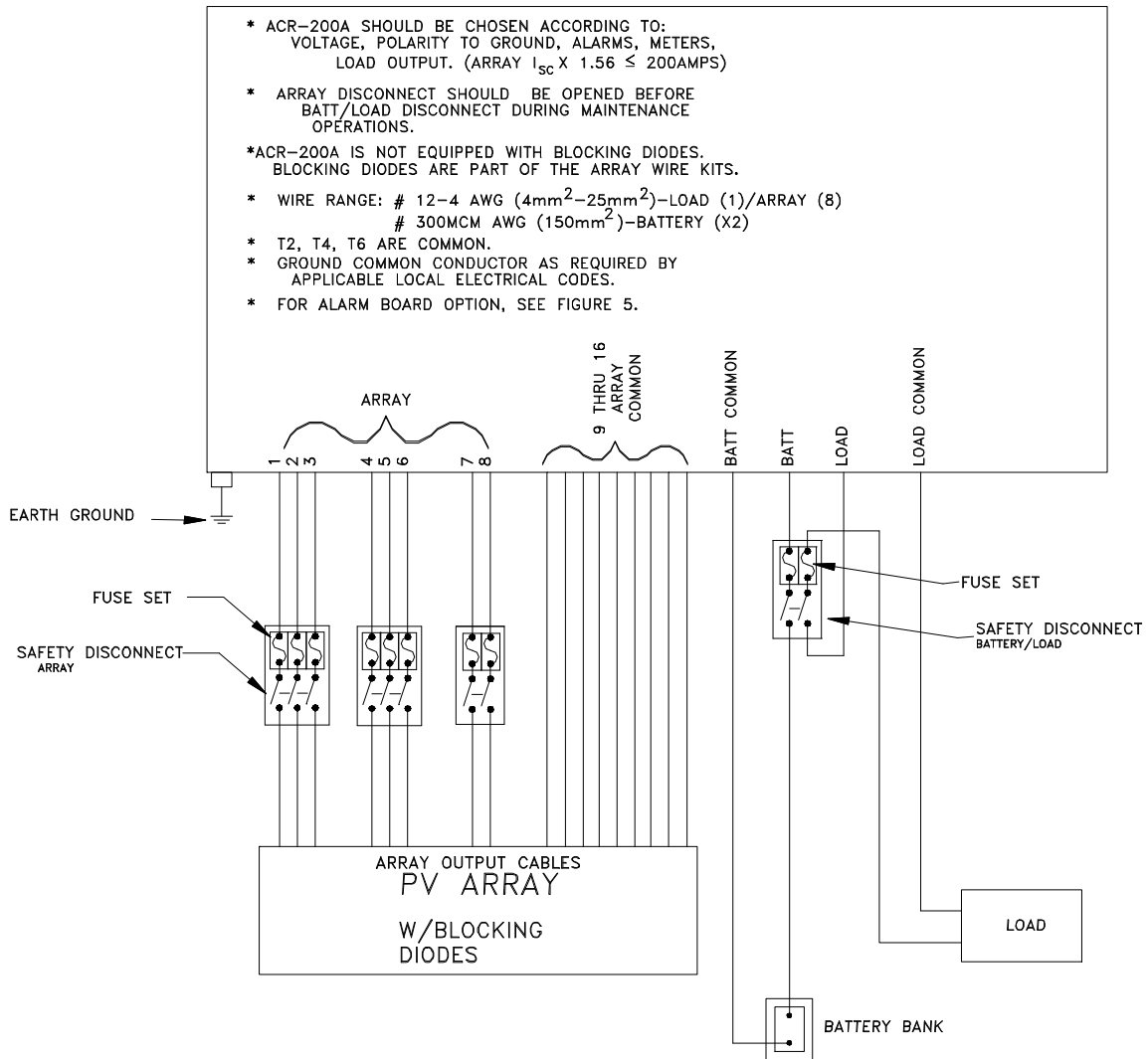


FIGURE 4. TYPICAL SYSTEM SCHEMATIC WITH AN ACR-200A

## ALARM BOARD (OPTIONAL)

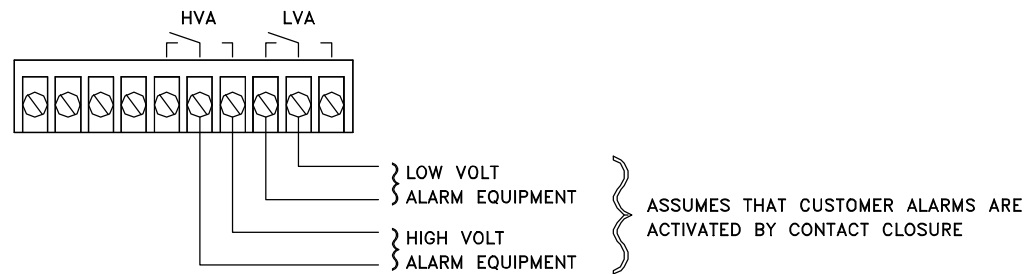


FIGURE 5

### 3.0 PROCEDURES FOR ARRAY WIRING

It is recommended that the following steps be followed when wiring the array.

- - - - -

### W A R N I N G

- - - - -

**Whenever modules are exposed to light,  
they will generate electricity. Harmful or  
lethal voltages can be achieved.**

1. Refer to the appropriate drawings for the specific voltage and array configuration that you are installing. For wiring Solarstate SRX-XX Regulator, use the Instruction Sheet supplied with the regulator.
2. Remove the modules from the packing boxes. Lay the packing boxes on the ground and then place the modules face down on top of the box in the position that the panels will be racked.

3. Using drawing WKS206\*\*\* through WKS248\*\*\*, locate the specified array configuration. Check all parts using "Parts Terminology" detail for identification. Using the corresponding dash (-) number on the drawing chart, locate appropriate wiring detail. Be sure to read the Wiring Instructions carefully before beginning any wiring.

4. After all module junction boxes (J-box) have been wired in accordance with the system specific wiring directions, start at the end J-box and check to insure that all connections are tight.

### **C A U T I O N**

**Do not connect the array to the regulator,  
battery, or load at this time.**

5. Refer to the manufactures procedures for the battery and regulator wiring. After the battery and regulator/load are wired, connect the system in the following order:

- a) Connect the Regulator to the Battery
- b) Connect the Regulator to the Array Output
- c) Connect the Load to the Regulator

6. When single conductor wires of the same color (both black or both gray) are used as an output cable, the negative and positive polarities should be clearly identified. A simple way of doing this is to "Tag" the positive wire with one ring of electrical tape at both ends and the negative wire with two rings of electrical tape at both ends (use a different color tape than the wire insulation).

### 3.1 Recommended Wiring Color Use.

- a. For 2-conductor cable with black and white conductors, use Black as Positive and White as Negative.
- b. For multiple single conductors, Red is Positive, Black is Negative, and White is the series connection wire.
- c. Red or Brown should be used primarily for Positive polarity. Green, Yellow, Green with yellow stripes, or bare copper wire is generally used as a ground wire.

**3.2 Grounding (If Applicable).** Grounding kits are available as optional additions to a system. Included in these kits are three 1/2-inch x 8-foot ground rods with five clamps for a basic system. Kits are also available for additional rows with two rods and three clamps. Solarex recommends the use of #2 AWG ( $35 \text{ mm}^2$ ), stranded, bare copper wire. Length of the ground wire must be calculated by size of the system and distance of equipment. Panel grounding clamps are used to ground each individual panel.

Solarex 60 series modules are listed by and have obtained a Class C Fire Rating from Underwriters Laboratories. Supplied with each module is the proper hardware to ensure a positive ground for each module. It is recommended to use #10 AWG ( $6 \text{ mm}^2$ ) stranded, bare copper wire to connect each module of the panel. However, when using Solarex style panel mounting kits, it may not be necessary to ground tie each individual module because the aluminum structure of the panel is an effective alternative.



## APPENDIX A

### AMERICAN/METRIC WIRE GAUGES

The approximate equivalency between American Wire Gauge (AWG) and Metric Wire sizes are shown in the following table.

AWG (#)	METRIC mm <sup>2</sup>
18	1.0
16	1.5
14	2.5
12	4
10	6
8	10
6	15
4	25
2	35
1/0	50
2/0	70
4/0	105
250 MCM	125
300 MCM	150

NOTE: The Metric equivalent normally represents the next size up in selection. This means the voltage drop using the metric equivalent of the specified AWG would be lowered e.g., #4 AWG cross section is 20.7mm<sup>2</sup> vs. 25mm<sup>2</sup> as shown above.

**VOLTAGE DROP FOR 10 AMP CURRENT AT 100 FOOT DISTANCE**

The following table shows the voltage drop ( $\Delta V$ ) occurring in a cable of the specified gauge carrying a current of 10A for a distance of 100 feet (two wires, each 100 feet) at 75°C.

AWG (#)	V (V)
18	16.90
16	10.58
14	6.52
12	4.10
10	2.58
8	1.62
6	1.02
4	0.64
2	0.40
1/0	0.25
2/0	0.20
4/0	0.13
250 MCM	0.11
300 MCM	0.09

**IMPORTANT**

Keep the voltage drop to a minimum to ensure proper operation of the system.

**APPENDIX B****REPLACEMENT PARTS  
ORDERING INFORMATION****Array Parts**

	<b><u>Part No.</u></b>
Add-On Terminal Kit	WK2ATK
Diode, Blocking (6V, 12V, 24V)	WK2BD-40
Diode, Blocking (24V, 48V, 96V, 200V)	WK2BD-400
Diode, 6A, 1000V (200V+)	22200004
Diode, Bypass	WK2BPD
Intermodule Wire Kit (N.E.C. compliant)	WK2IMBRW
Interpanel Wire Kit (N.E.C. compliant)	WK2IPBR
Termination, Output Kit	WK2OUTK
Offset Lug Terminal Kit	WK2OLC

**Cabling (AWG)**

#10-2 SEO, Stranded, Bulk	22210006
#10-2 SEO, Stranded, 15 ft. Kit	WK2SEO1015F
#10-2 SEO, Stranded, 25 ft. Kit	WK2SEO1025F
#10-1 USE/UF, Stranded, Bulk	22210007
#6-1 USE/UF, Stranded, Bulk	22210001
#4-1 USE/UF, Stranded, Bulk	22210000
#2-1 USE/UF, Stranded, Bulk	22210002
#1/0-1 USE/UF, Stranded, Bulk	22210005
#4/0-1 USE/UF, Stranded, Bulk	22210010

**Connectors**

* Pg 13.5, Nylon, 0.19 - 0.35	28421405
1/2 NPT, Nylon, 0.125 - 0.375	28421408
1/2 NPT, Nylon, 0.310 - 0.560	28421406
1/2 NPT, Metallic, 0.50 - 0.75	22220050
1/2 NPT, Nylon, 0.50 - 0.80	28421389
3/4 NPT, Nylon, 0.50 - 0.75	2700853
3/4 NPT, Metallic, 0.72 - 0.88	22220120
1" NPT, Nylon, 0.70 - 0.95	2700872

\*"Pg" hub threads are conduit threads per DIN 40430.

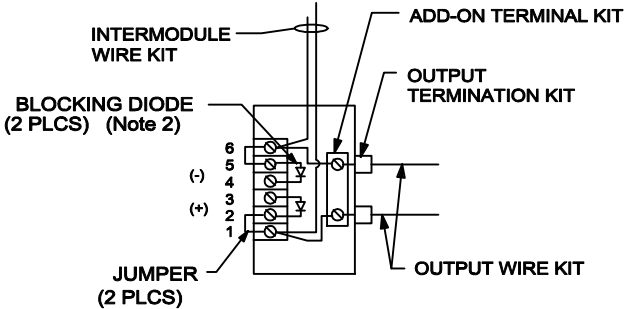
**Terminals**

Battery Lug #14-4 AWG, 1/4 Bolt	23501103
Battery Lug #4-2/0 AWG, 3/8 Bolt	23501102

**Grounding**

Bare Copper Cable, #10 AWG, Stranded	31260000
Bare Copper Cable, #2 AWG, Stranded	31260005
Ground Rod, Copper plate, 1/2" x 8'	31260009
Ground Rod Clamp	31260003
Grounding Terminal, #1/0-14 AWG, Panel	23501105

REVISIONS			
LTR	ECO NO.	DESCRIPTION OF CHANGE	CHANGED BY / DATE
A	EC-00-043	CREATE THREADED WIRE KITS	JK 4/21/00



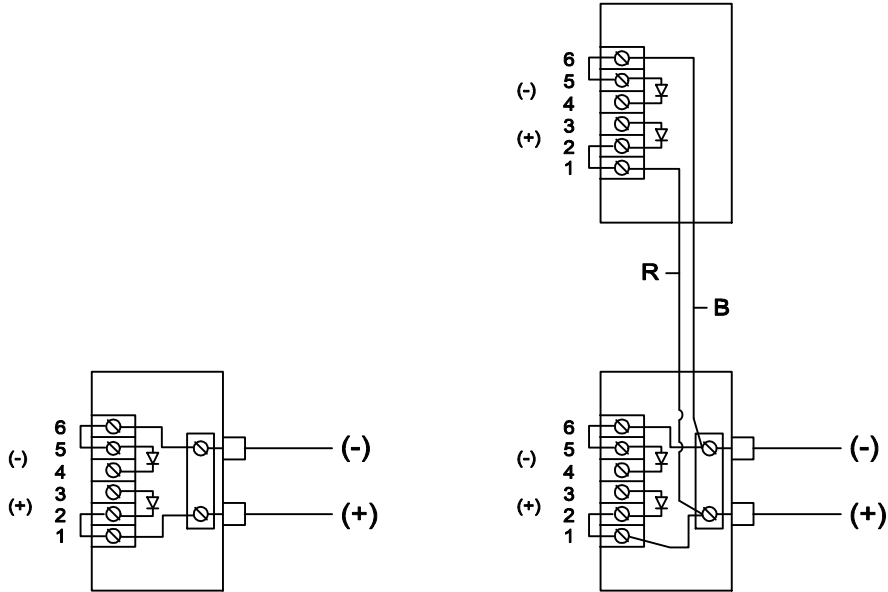
PARTS TERMINOLOGY

DESCRIPTION	SOLAREX STOCK NO	SYSTEM DASH NO.	
		-01	-02
		WKS20601X	WKS20602X
MODULES (ORDERED SEPARATELY)	Not included	(1)	(2)
INTERMODULE WIRE KIT	WK2IMBRW	-	1
OUTPUT TERMINATION Kit	WK2OUTK	1	1
ADD-ON TERMINAL KIT	WK2ATK	1	1
BLOCKING DIODE KIT	WK2BD-40	2	4
HANDBOOK, PV ARRAY WIRING	42500066	1	1

OUTPUT OPTIONS (note 3) (ordered separately)			
OUTPUT #10-2 SEO Kit,15'	WK2SEO1015F	-	-
OUTPUT #10-2 SEO Kit,25'	WK2SEO1025F	-	-
OUTPUT #4 USE/UF	22210000	51FT	25FT
OUTPUT #6 USE/UF	22210001	32FT	16FT
OUTPUT #10 USE/UF	22210007	12FT	-

NOTES: READ CAREFULLY

- 1- INTERMODULE KITS ARE SUPPLIED WITH 3 WIRES; RED (+), BLACK (-), WHITE (SERIES). ALL WIRES MAY NOT BE REQUIRED, DEPENDING ON THE SYSTEM ORDERED. WHEN WIRING, PLEASE TAKE NOTE OF THE COLORS SPECIFIED AND REMOVE THE EXTRA WIRE FROM THE KIT.
- 2- MOVE JUMPER LOCATED AT TERMINALS 2 & 3 TO TERMINALS 1 & 2 AND JUMPER AT TERMINALS 4 & 5 TO TERMINALS 5 & 6. LOCATE BLOCKING DIODES AT TERMINALS 2 & 3 AND 4 & 5, AS SHOWN.
- 3- LENGTH OF OUTPUT CABLE IN THE CHART IS THE MAXIMUM 'ELECTRICAL' DISTANCE FOR THE SYSTEM. THIS LENGTH IS THE SUM OF THE POSITIVE WIRE LENGTH AND THE NEGATIVE WIRE LENGTH. LENGTHS LESS THAN THE MAXIMUM ARE ACCEPTABLE. FOR U.S.E. TYPE CABLES (SINGLE CONDUCTOR) (2 EA.) CUT LENGTH OF ONE HALF OF THE SPECIFIED DISTANCE ARE REQUIRED. 'NOT TO EXCEED VOLTAGE DROP USED: 0.12V. VOLTAGE DROP CALCULATIONS USED  $I_{pp}$  FOR SX-64 (7.32A) AND COPPER WIRE RESISTANCE AT 75°C.
- 4- IT IS RECOMMENDED THAT ALL CONNECTIONS BE CHECKED AND RE-TIGHTENED SOMETIME AFTER INITIAL INSTALLATION.



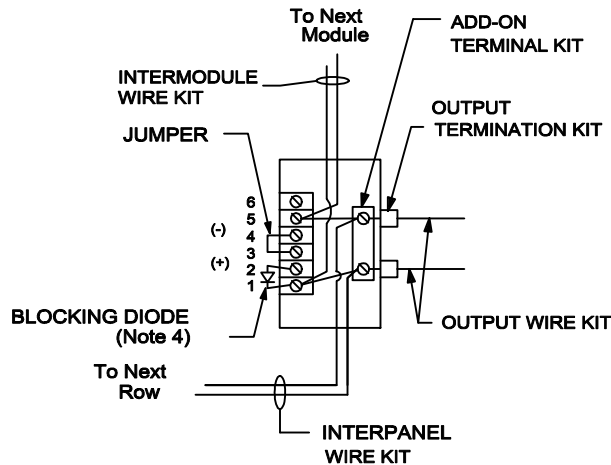
WIRING FOR:  
-01

WIRING FOR:  
-02

LEGEND

R=RED (POSITIVE)  
B=BLACK (NEGATIVE)  
W=WHITE (SERIES)

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		S.WINPIGLER							
		MATERIAL:		DATE 3/22/93					
PART NO.:									
FINISH:		UNLESS OTHERWISE SPECIFIED, DIMENSIONS: mm [INCHES] PRIMARY DIMS ARE MILLIMETERS, INCH DIMS FOR REFERENCE ONLY						<div>6V BASIC WIRING SYSTEMS</div>	
		LINEAR DIMENSIONS OR DIAMETER DIMENSIONS							
THIRD ANGLE PROJECTION	PREVIOUS DRAWING NO.	0.5 - 6	6 - 30	30 - 120	120 - 315	315-1000	1000-2000	DRAWING NUMBER:	REV
		± 0.1	± 0.2	± 0.3	± 0.5	± 0.8	± 1.2	WKS206***	A
		DO NOT SCALE THIS DRAWING			SCALE: NONE		SHEET 1 OF 1		



PARTS TERMINOLOGY

DESCRIPTION	SOLAREX STOCK NO	SYSTEM DASH NO.					
		-01	-02	-03	-04	-05	-06
		WKS21201X	WKS21202X	WKS21203X	WKS21204X	WKS21205X	WKS21205M
MODULES (ORDERED SEPARATELY)	Not included	(1)	(2)	(3)	(4)	(5)	(5)
BLOCKING DIODE KIT	WK2BD-40	1	2	3	4	5	5
INTERPANEL WIRE KIT	WK2IPBR	-	-	-	-	-	1
INTERMODULE WIRING KIT	WK2IMBRW	-	1	2	3	4	3
OUTPUT TERMINATION KIT	WK2OUTK	1	1	1	1	1	1
ADD-ON TERMINAL KIT	WK2ATK	1	1	1	1	1	1
HANDBOOK, PV ARRAY WIRING	42500066	1	1	1	1	1	1

OUTPUT OPTIONS (note 3) (ordered separately)							
OUTPUT #10-2 SEO Kit,15'	WK2SEO1015F	1	-	-	-	-	-
OUTPUT #10-2 SEO Kit,25'	WK2SEO1025F	1	-	-	-	-	-
OUTPUT #4 USE/UF	22210000	200FT	100FT	65FT	50FT	40FT	40FT
OUTPUT #6 USE/UF	22210001	120FT	60FT	40FT	30FT	25FT	25FT
OUTPUT #10 USE/UF	22210007	50FT	25FT	17FT	12FT	10FT	10FT

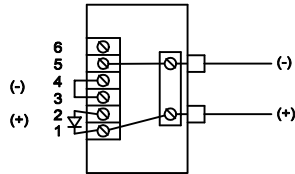
NOTES: READ CAREFULLY

1- INTERMODULE KITS ARE SUPPLIED WITH 3 WIRES; RED (+), BLACK (-), WHITE (SERIES). ALL WIRES MAY NOT BE REQUIRED, DEPENDING ON THE SYSTEM ORDERED. WHEN WIRING, PLEASE TAKE NOTE OF THE COLORS SPECIFIED AND REMOVE THE EXTRA WIRE FROM THE KIT.

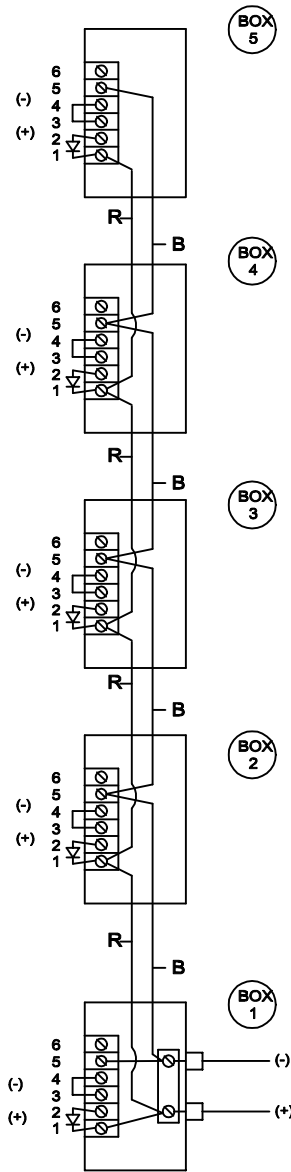
2- MOVE JUMPER LOCATED AT TERMINALS 2 & 3 TO TERMINALS 1 & 2 AND JUMPER AT TERMINALS 4 & 5 TO TERMINALS 5 & 6. LOCATE BLOCKING DIODES AT TERMINALS 2 & 3 AND 4 & 5, AS SHOWN.

3- LENGTH OF OUTPUT CABLE IN THE CHART IS THE MAXIMUM 'ELECTRICAL' DISTANCE FOR THE SYSTEM. THIS LENGTH IS THE SUM OF THE POSITIVE WIRE LENGTH AND THE NEGATIVE WIRE LENGTH. LENGTHS LESS THAN THE MAXIMUM ARE ACCEPTABLE. FOR U.S.E. TYPE CABLES (SINGLE CONDUCTOR) (2 EA.) CUT LENGTH OF ONE HALF OF THE SPECIFIED DISTANCE ARE REQUIRED. \*NOT TO EXCEED VOLTAGE DROP USED: 0.12V. VOLTAGE DROP CALCULATIONS USED  $I_{pp}$  FOR SX-64 (7.32A) AND COPPER WIRE RESISTANCE AT 75°C.

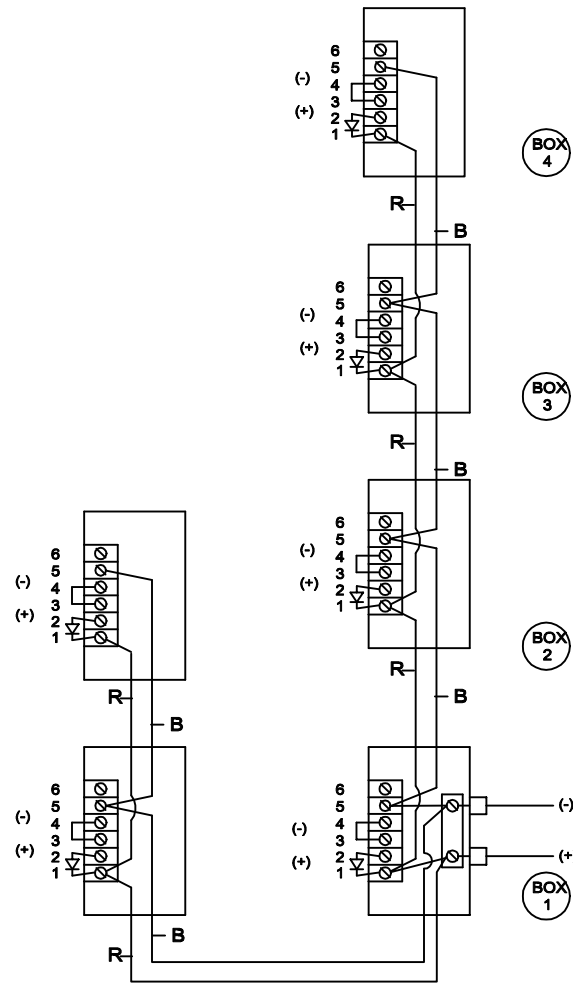
4- IT IS RECOMMENDED THAT ALL CONNECTIONS BE CHECKED AND RE-TIGHTENED SOMETIME AFTER INITIAL INSTALLATION.



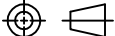
WIRING FOR:  
-01

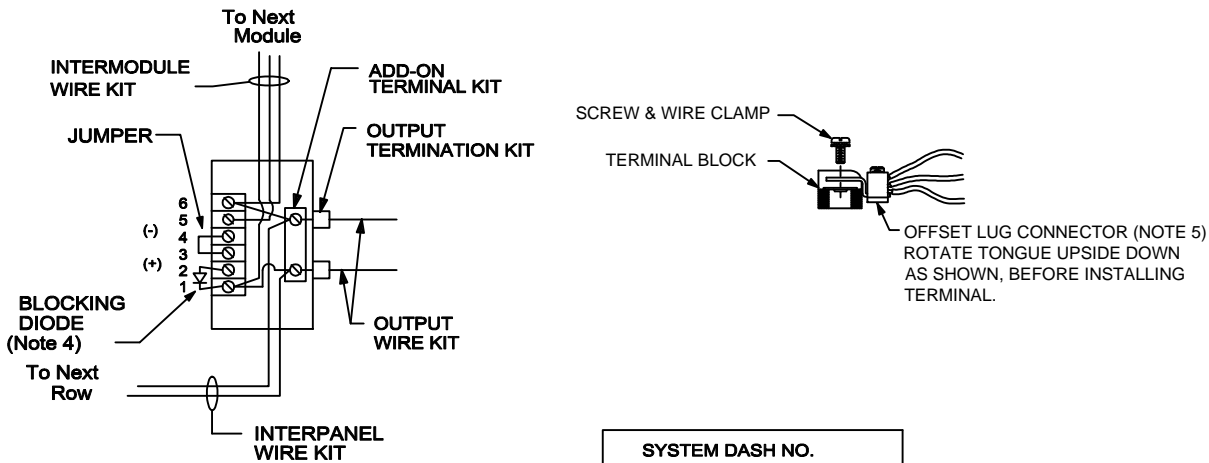


WIRING FOR:  
-02 = BOXES 1 & 2  
-03 = " 1 thru 3  
-04 = " 1 thru 4  
-05 = " 1 thru 5



WIRING FOR:  
-06 = BOXES 1 thru 5 OR 1 thru 3 + 5 + 6

THIS DRAWING IS PROPERTY OF BP SOLAREX AND MAY NOT BE COPIED (IN WHOLE OR IN PART) USED FOR MANUFACTURE OR DISCLOSED WITHOUT PRIOR CONSENT OF BP SOLAREX OR AN AUTHORIZED AGENT.		DRAWN		CHECKED		APPROVED		<div><div>BP SOLAREX</div><div>BP SOLAREX MARYLAND, U.S.A.</div></div>			
		S.WINPIGLER									
		DATE 2/8/93									
MATERIAL:		PART NO.:						<div>12V BASIC WIRING SYSTEMS</div>			
FINISH:		UNLESS OTHERWISE SPECIFIED, DIMENSIONS: mm [INCHES] PRIMARY DIMS ARE MILLIMETERS, INCH DIMS FOR REFERENCE ONLY									
		LINEAR DIMENSIONS OR DIAMETER DIMENSIONS									
THIRD ANGLE PROJECTION	PREVIOUS DRAWING NO.	0.5 - 6	6 - 30	30 - 120	120 - 315	315-1000	1000-2000	DRAWING NUMBER:	WKS212***	REV A	
		± 0.1	± 0.2	± 0.3	± 0.5	± 0.8	± 1.2	DO NOT SCALE THIS DRAWING		SCALE: NONE	SHEET 1 OF 1



PARTS TERMINOLOGY

DESCRIPTION	SOLAREX STOCK NO	SYSTEM DASH NO.					
		-01	-02	-03	-04	-05	-06
MODULES (ORDERED SEPARATELY)	Not included	(2)	(4)	(6)	(6)	(8)	(10)
BLOCKING DIODE KIT	WK2BD-40	1	2	3	3	4	5
INTERPANEL WIRE KIT	WK2IPBR	-	-	1	-	1	2
INTERMODULE WIRING KIT	WK2IMBRW	1	3	4	5	6	7
OUTPUT TERMINATION Kit	WK2OUTK	1	1	1	1	1	1
ADD-ON TERMINAL KIT	WK2ATK	1	1	1	1	1	1
OFFSET LUG CONNECTOR	WK2OLC	-	-	-	-	-	2
HANDBOOK, PV ARRAY WIRING	42500066	1	1	1	1	1	1

OUTPUT OPTIONS (note 3) (ordered separately)							
OUTPUT #10-2 SEO Kit,15'	WK2SEO1015F	1	1	1	1	-	-
OUTPUT #10-2 SEO Kit,25'	WK2SEO1025F	1	1	-	-	-	-
OUTPUT #4 USE/UF	22210000	400FT	200FT	130FT	130FT	100FT	80FT
OUTPUT #6 USE/UF	22210001	240FT	120FT	80FT	80FT	60FT	50FT
OUTPUT #10 USE/UF	22210007	100FT	50FT	33FT	33FT	25FT	20FT

NOTES: READ CAREFULLY

1- INTERMODULE KITS ARE SUPPLIED WITH 3 WIRES; RED (+), BLACK (-), WHITE (SERIES). ALL WIRES MAY NOT BE REQUIRED, DEPENDING ON THE SYSTEM ORDERED. WHEN WIRING, PLEASE TAKE NOTE OF THE COLORS SPECIFIED AND REMOVE THE EXTRA WIRE FROM THE KIT.

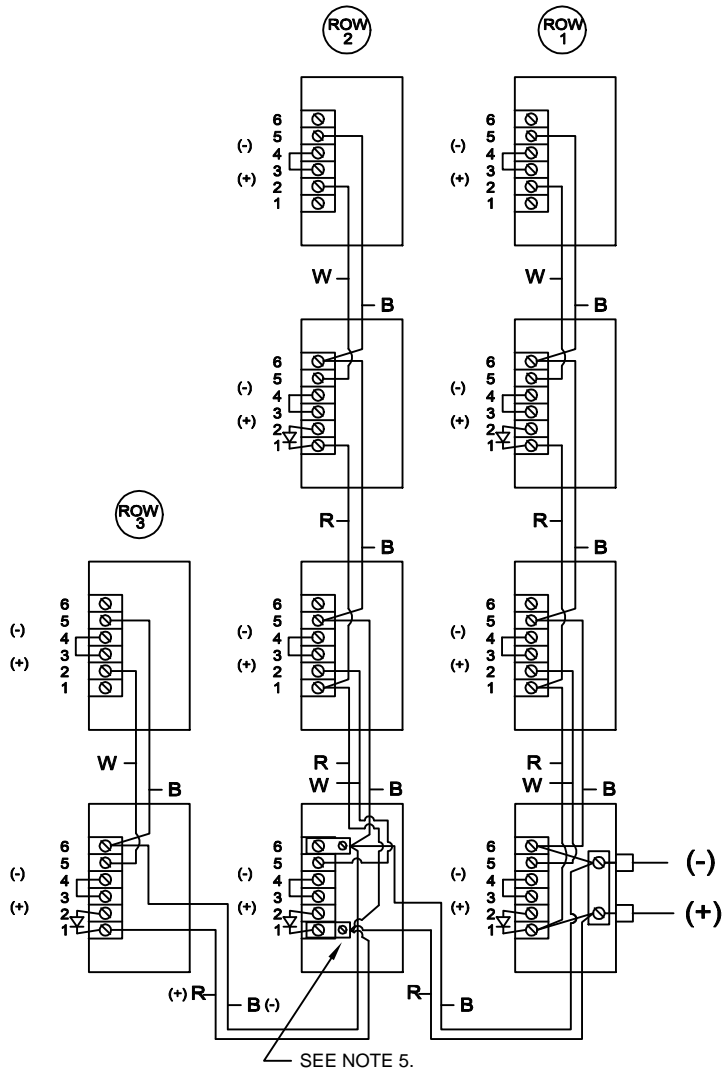
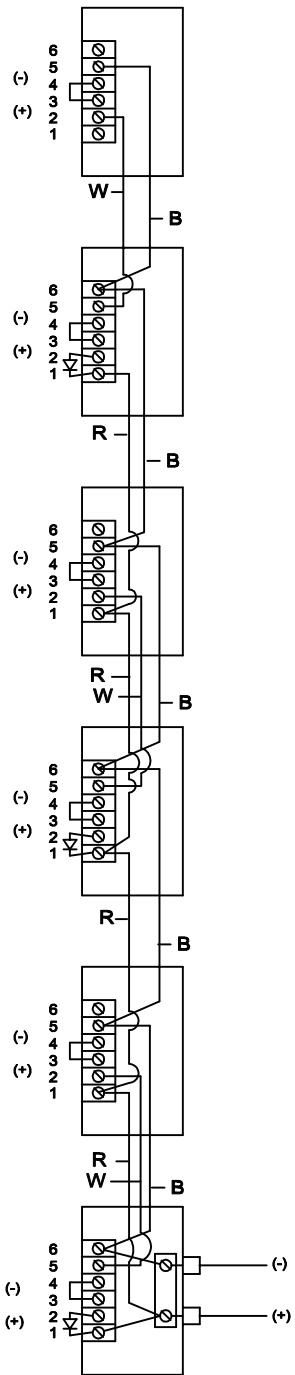
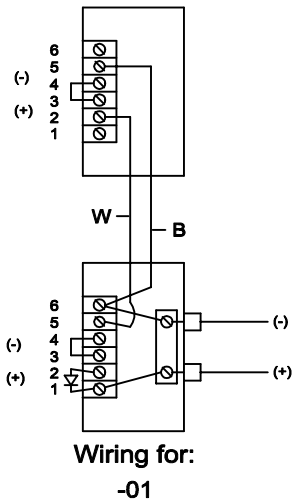
2- MOVE JUMPER LOCATED AT TERMINALS 2 & 3 TO TERMINALS 1 & 2 AND JUMPER AT TERMINALS 4 & 5 TO TERMINALS 5 & 6. LOCATE BLOCKING DIODES AT TERMINALS 2 & 3 AND 4 & 5, AS SHOWN.

3- LENGTH OF OUTPUT CABLE IN THE CHART IS THE MAXIMUM 'ELECTRICAL' DISTANCE FOR THE SYSTEM. THIS LENGTH IS THE SUM OF THE POSITIVE WIRE LENGTH AND THE NEGATIVE WIRE LENGTH. LENGTHS LESS THAN THE MAXIMUM ARE ACCEPTABLE. FOR U.S.E. TYPE CABLES (SINGLE CONDUCTOR) (2 EA.) CUT LENGTH OF ONE HALF OF THE SPECIFIED DISTANCE ARE REQUIRED. \*NOT TO EXCEED VOLTAGE DROP USED: 0.12V. VOLTAGE DROP CALCULATIONS USED 1pp FOR SX-64 (7.32A) AND COPPER WIRE RESISTANCE AT 75°C.

4- IT IS RECOMMENDED THAT ALL CONNECTIONS BE CHECKED AND RE-TIGHTENED SOMETIME AFTER INITIAL INSTALLATION.

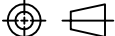
LEGEND:

R= RED (POSITIVE)  
B= BLACK (NEGATIVE)  
W= WHITE (SERIES)

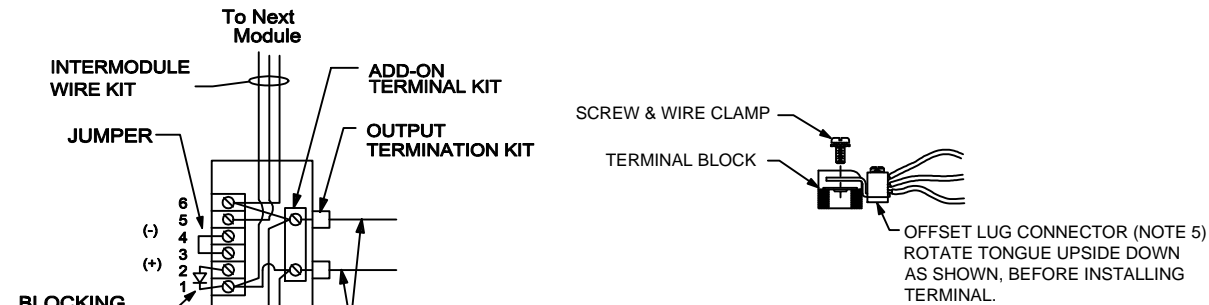


WIRING FOR:

-02 = ROW 1  
-03 = ROWS 1 & 3  
-05 = ROWS 1 & 2 (OFFSET LUG CONNECTORS NOT REQUIRED)  
-06 = ROWS 1, 2 & 3

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		S.WINPIGLER							
		DATE 3/22/93							
MATERIAL:		PART NO.:						24V BASIC WIRING SYSTEMS	
FINISH:		UNLESS OTHERWISE SPECIFIED, DIMENSIONS: mm [INCHES] PRIMARY DIMS ARE MILLIMETERS, INCH DIMS FOR REFERENCE ONLY							
		LINEAR DIMENSIONS OR DIAMETER DIMENSIONS							
THIRD ANGLE PROJECTION	PREVIOUS DRAWING NO.	0.5 - 6	6 - 30	30 - 120	120 - 315	315-1000	1000-2000	DRAWING NUMBER:	REV
		± 0.1	± 0.2	± 0.3	± 0.5	± 0.8	± 1.2	WKS224***	A
								DO NOT SCALE THIS DRAWING	SHEET 1 OF 1

REVISIONS			
LTR	ECO NO.	DESCRIPTION OF CHANGE	CHANGED BY / DATE
A	EC-00-043	CREATE THREADED WIRE KITS	JK 4/21/00



SYSTEM DASH NO.					
-01	-02	-03	-04	-05	
WKS24804X	WKS24808M	WKS24812M	WKS24816M	WKS24820M	
(4)	(8)	(12)	(16)	(20)	
1	2	3	4	5	
4	8	12	16	20	
3	6	9	12	15	
-	1	2	3	4	
1	1	1	1	1	
1	1	1	1	1	
-	-	1	2	3	
1	1	1	1	1	

DESCRIPTION	SOLAREX STOCK NO	WKS24804X	WKS24808M	WKS24812M	WKS24816M	WKS24820M
MODULES (ORDERED SEPARATELY)	Not included	(4)	(8)	(12)	(16)	(20)
BLOCKING DIODE KIT	WK2BD-400	1	2	3	4	5
BYPASS DIODE KIT	WK2BPD	4	8	12	16	20
INTERMODULE WIRE KIT	WK2IMBRW	3	6	9	12	15
INTERPANEL WIRE KIT	WK2IPBR	-	1	2	3	4
OUTPUT TERMINATION KIT	WK2OUTK	1	1	1	1	1
ADD-ON TERMINAL KIT	WK2ATK	1	1	1	1	1
OFFSET LUG CONNECTOR	WK2OLC	-	-	1	2	3
HANDBOOK, PV ARRAY WIRING	42500066	1	1	1	1	1

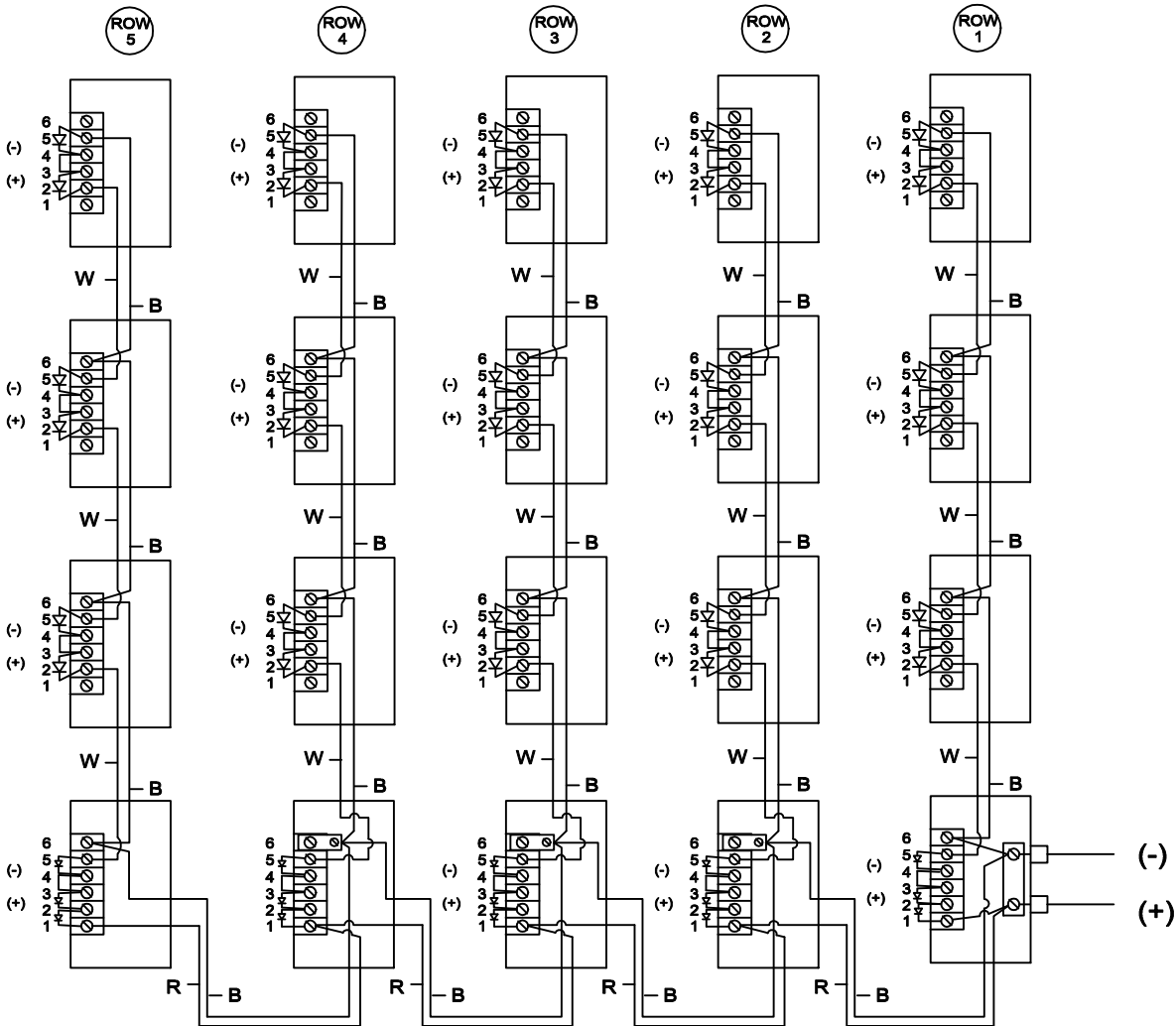
OUTPUT OPTIONS (note 3) (ordered separately)					
OUTPUT #10-2 SEO Kit,15'	WK2SEO1015F	1	1	1	1
OUTPUT #10-2 SEO Kit,25'	WK2SEO1025F	1	1	1	1
OUTPUT #4 USE/UF	22210000	800FT	400FT	265FT	200FT
OUTPUT #6 USE/UF	22210001	500FT	250FT	165FT	125FT
OUTPUT #10 USE/UF	22210007	200FT	100FT	65FT	50FT

NOTES: READ CAREFULLY

- 1- INTERMODULE KITS ARE SUPPLIED WITH 3 WIRES; RED (+), BLACK (-), WHITE (SERIES). ALL WIRES MAY NOT BE REQUIRED, DEPENDING ON THE SYSTEM ORDERED. WHEN WIRING, PLEASE TAKE NOTE OF THE COLORS SPECIFIED AND REMOVE THE EXTRA WIRE FROM THE KIT.
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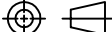
LEGEND:

- R= RED (POSITIVE)  
B= BLACK (NEGATIVE)  
W= WHITE (SERIES)



WIRING FOR:

- 01 = ROW 1  
-02 = ROWS 1 & 5  
-03 = ROWS 1, 2 & 5  
-04 = ROWS 1 thru 3 & 5  
-05 = ROWS 1 thru 5

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		S.WINPIGLER							
		DATE 3/22/93							
MATERIAL:		PART NO.:						48V BASIC WIRING SYSTEMS	
FINISH:		UNLESS OTHERWISE SPECIFIED, DIMENSIONS: mm [INCHES] PRIMARY DIMS ARE MILLIMETERS, INCH DIMS FOR REFERENCE ONLY							
		LINEAR DIMENSIONS OR DIAMETER DIMENSIONS							
THIRD ANGLE PROJECTION	PREVIOUS DRAWING NO.	0.5 - 6	6 - 30	30 - 120	120 - 315	315-1000	1000-2000	DRAWING NUMBER:	REV
		± 0.1	± 0.2	± 0.3	± 0.5	± 0.8	± 1.2	WKS248***	A
DO NOT SCALE THIS DRAWING								SCALE: NONE	SHEET 1 OF 1