



Installation Guide



Trace™ Combiner Box 6

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IMPORTANT SAFETY INSTRUCTIONS

This manual contains important safety instructions that should be followed during the installation and maintenance of this product.

To reduce the risk of electrical shock, and to ensure the safe installation and operation of this product, the following safety symbols have been placed throughout this manual to indicate dangerous conditions and important safety instructions.



WARNING - A dangerous voltage or condition exists in this area. Use extreme caution when performing these tasks.

AVERTISSEMENT - Une tension ou condition dangereuse existe dans cette zone. Faire preuve d'extrême prudence lors de la réalisation de ces tâches.



CAUTION - This procedure is critical to the safe installation or operation of the unit. Follow these instructions closely.

ATTENTION - Cette procédure est essentielle à l'installation ou l'utilisation de l'unité en toute sécurité. Suivre ces instructions de près.



NOTE - This statement is important. Follow instructions closely.

NOTE - Cette déclaration est importante. Suivre les instructions de près.

- All electrical work must be done in accordance with local, national, and/or international electrical codes.
- Before installing or using this device, read all instructions and cautionary markings located in (or on) the TCB 6, the manual, the batteries, the inverter, the PV array, etc.
- To reduce the chance of short-circuits when installing or working with the inverter, the batteries, or the PV array, use insulated tools.
- Remove all jewelry while installing this system. This will greatly reduce the chance of accidental exposure to live circuits.

1.0 Introduction

The Trace™ Combiner Box (TCB 6) provides a convenient, low-cost way to meet the National Electric Code (NEC) requirements for series fusing of Photovoltaic (PV) modules. The TCB 6 accommodates six PV source circuits fused at up to 20 amps per circuit. This allows the TCB 6 to be used with a wide variety of PV modules. The TCB 6 can be used in 12, 24 and 48 Vdc systems and has a maximum output rating of 100 amps continuous. The powder-coated steel NEMA 3R enclosure allows the TCB 6 to be used for either indoor or outdoor applications.



Figure 1
Trace™ Combiner Box (TCB 6)

1.0 INTRODUCTION

Specifications

Number of Inputs	6 positive, 6 negative
Input Wire Size	6-14 AWG
Input Fuse Size (Maximum)	20 amps, type GBB
Output Current (Maximum)	100 amps continuous
Number of outputs	3 positive, 3 negative
Output Wire Size	2-14 AWG
Enclosure type	Powder-coated steel, NEMA 3R

Purpose

This manual describes the procedure for installing the Trace™ Combiner Box (TCB 6). Please read this manual *carefully* before starting. If you have any questions, please contact your local dealer for assistance.

2.0 Installation

Required Equipment

Tools Required

Phillips screwdrivers
slotted screwdrivers
torque wrench

multimeter (true rms)
wire strippers
electrical tape

level
pencil
utility knife

Hardware/Materials Required

TCB 6 Combiner Box
wood screws and washers (not supplied)
anchors for screws (material dependent)

conduit and appropriate fittings
wiring

Removing the Front Cover

1. Remove the front cover by unscrewing the two 10-32 x 5/16" Phillips screws on the bottom of the front cover.

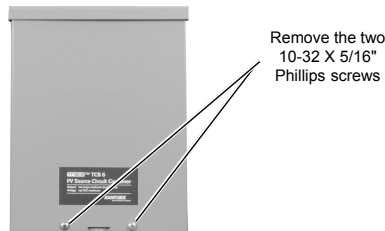


Figure 2
Removing the Front Cover

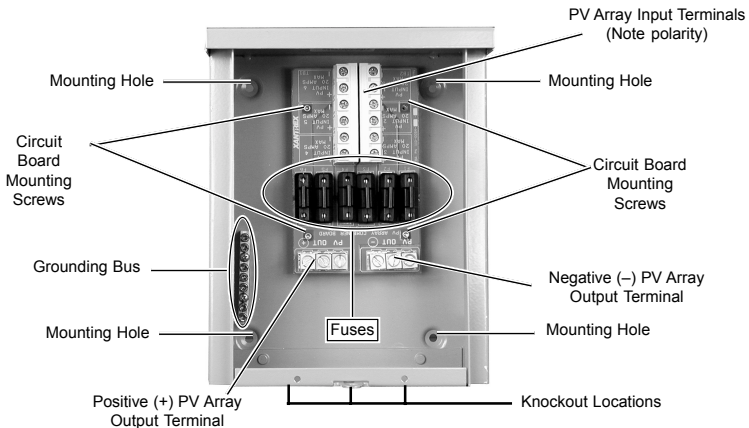


Figure 3
TCB 6 Combiner Box Interior

2.0 INSTALLATION

Pre-Installation



NOTE: This equipment should be installed and serviced by qualified personnel only. Follow all applicable codes during installation.



NOTE: Do not attempt to install this equipment unless you are thoroughly familiar with the operation of PV power systems.



WARNING: PV MODULES CAN PRODUCE HAZARDOUS VOLTAGES WHENEVER THEY ARE EXPOSED TO SUNLIGHT. MULTIPLE POWER SOURCES MAY BE PRESENT INSIDE THE ENCLOSURE. HAZARDOUS VOLTAGES MAY EXIST ON EXPOSED WIRING AND TERMINALS EVEN WITH DISCONNECTS IN THE OPEN POSITION. TO REDUCE THE RISK OF SHOCK DURING INSTALLATION, COVER THE ARRAY WITH AN OPAQUE (DARK) MATERIAL BEFORE MAKING ANY CONNECTIONS. USE EXTREME CAUTION WHEN MAKING CONNECTIONS, INSTALLING, OR REPLACING FUSES.

1. Remove the fuses. Do not install the fuses at this time.
2. Factory supplied dual knockouts (1/2" - 3/4" and 3/4" - 1") are supplied on the bottom of the TCB 6 enclosure.

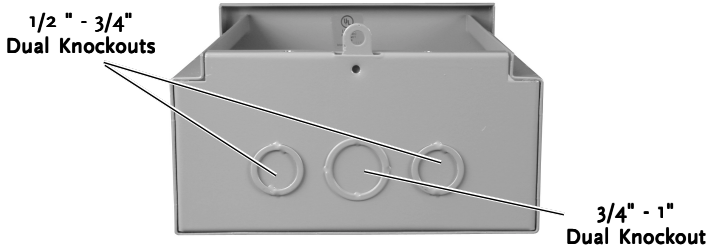


Figure 4
Knockout Locations on the Bottom of the TCB 6

3. If it is necessary to add additional knockouts for input or output wiring conduits, remove the printed wiring board before drilling or punching the enclosure to avoid damaging the components.
 - a. To remove the printed wiring board, remove the four circuit board mounting screws as shown in Figure 2 and lift out the board.
 - b. Drill the required additional holes.



CAUTION: Prior to re-installing the printed wiring board, be sure to remove any metal chips or filings that could create electrical shorts.

- c. Replace the printed wiring board.

Location



NOTE: Plan all wiring runs before beginning the installation process. Locating the TCB 6 close to the PV arrays will minimize wiring costs.

The TCB 6 can be installed indoors or outdoors preferably in a shaded location. The TCB 6 should be installed vertically in a location that will allow easy servicing or replacement of the internal fuses.

If the TCB 6 is installed outdoors, water-tight type conduits or strain relief fittings must be used and the unit must be a minimum of 45" above ground level.

Mounting

The TCB 6 must be mounted vertically, such as on wallboard or wood siding, or on a pole with additional mounting hardware. Installation onto wallboard or concrete requires the use of anchors to properly hold the screws.



WARNING: BEFORE DRILLING HOLES TO MOUNT THE TCB 6, ENSURE THERE ARE NO ELECTRICAL WIRES OR PLUMBING IN THIS AREA.

1. Determine where the TCB 6 is to be installed. It should be as close to the PV panel as possible. The *bottom* of the unit must be at least 45 inches from the floor or ground when mounted.
2. Using the dimensional drawing in Figure 5, mark the locations for drilling the mounting holes.
3. Drill the holes using a #10 (0.193 inch diameter) drill bit. Drill appropriately sized holes for anchors when installing on non-wood surfaces.
4. Mount the TCB 6 to a secure surface with the appropriate hardware using the 4 mounting holes in the back of the enclosure.
5. Seal any open holes with silicon caulking.

2.0 INSTALLATION

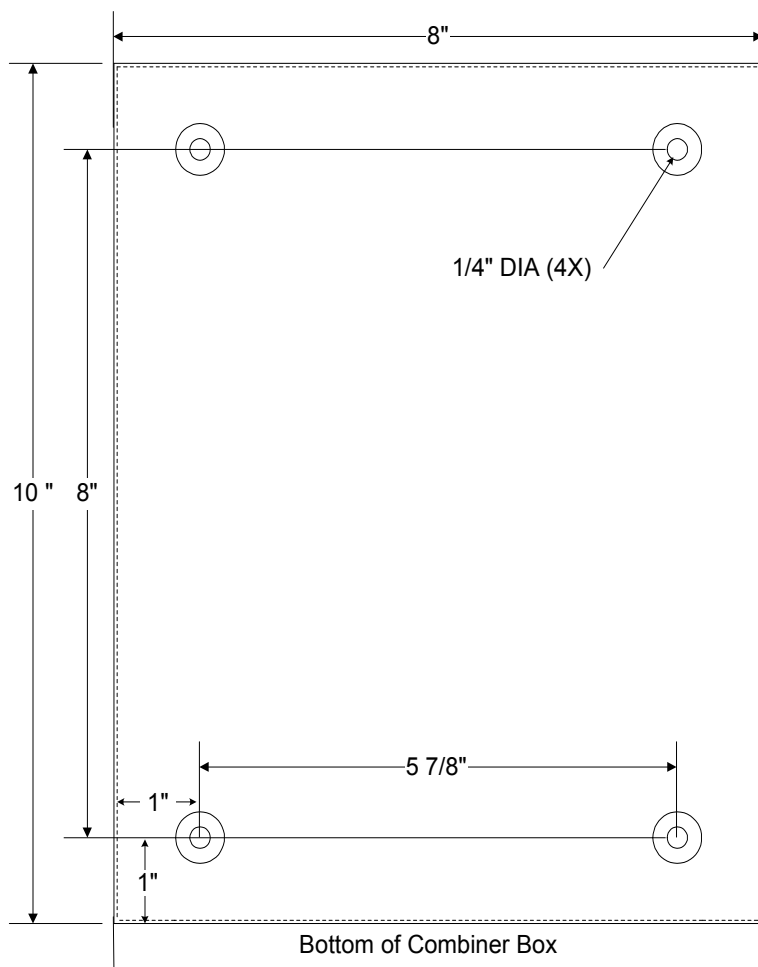


Figure 5
Dimensional Drawing (Not to Scale)

DC Grounding

The DC ground bus is for equipment (chassis) grounding only and should not be used as a system ground bond if there are other ground points in the system.

Fuse Sizing

In any electrical system, fuses are used to protect wiring and equipment from excessive currents that can cause damage, heating, or in extreme cases, even fire. If the fuse is too small, it could blow during normal operation. If the fuse is too big, it cannot provide the needed protection. In PV systems, the minimum and maximum size of the series fuse is determined by the electrical ratings of the PV module as well as by UL and National Electric Code (NEC) requirements. Be sure to consult with your PV module manufacturer for appropriate fuse ratings.

The *minimum* sizes of fuses and wiring are calculated using the Short Circuit Current Rating (Isc) of the PV module. The NEC requires that all fuses and wiring must be sized for a minimum of 1.56 times the short circuit rating of the module. The *maximum* allowable fuse size is based on UL testing and is referred to as the "UL Series Fuse Rating". The Isc rating and the UL Series Fuse Rating are normally printed on the manufacturers label on the back of the PV module. If the module is not UL listed or does not have a UL Series Fuse Rating, use the minimum size fuse allowed by the NEC as calculated above (i.e., 1.56 X Isc).

The TCB 6 comes with 6 type-GBB 20 amp fuses installed, but depending on the PV modules used, these fuses might have to be replaced with smaller fuses of the same type to meet local electrical codes. ***Fuses larger than 20 amps should not be used.***



NOTE: The TCB 6 is rated for 100 amps of **maximum** design current. PV circuits must be oversized by design to account for conditions when insolation is greater than 1000 watts per square meter. Although the 20 amp fuses will theoretically allow 120 amps to be applied, **always design for a maximum of 100 amps of PV input current.** With appropriate fuse deratings, per NEC Code, the maximum allowed current is 16 amps (12.8 ISC) for any of the six circuits.



CAUTION: Do not use fuses larger than 20 amps or damage to the unit could occur.

2.0 INSTALLATION

Fuse Replacement

Check the label of the PV module for the maximum series fuse size. Or ask your local dealer or the PV module manufacturer. **Use only type GBB Fuses, no larger than 20 amps.** These fuses may be purchased through your authorized Xantrex Distributor or through Newark Electronics or Allied Electronics (see Table 1).

Amp Rating	Cooper-Bussmann Part Number	Newark Electronics ¹ Part Number	Allied Electronics ² Part Number
5	GBB-5	27F2481	N/A
6	GBB-6	27F2482	740-4044
8	GBB-8	27F2484	740-4045
10	GBB-10	27F2486	740-9896
15	GBB-15	30F178	740-4949
20	GBB-20	30F179	740-4950

Table 1
Replacement Fuses for the TCB 6

¹ NEWARK ELECTRONICS (1-800-4-NEWARK) or www.newark.com

² ALLIED ELECTRONICS (1-800-433-5700) or www.alliedelec.com

Fuse Removal and Replacement

1. To remove the fuses, pull straight out on the fuse cap handle.
2. Open the fuse holder.
3. Either remove the fuse or place the fuse inside the holder.
4. Close the holder and return the fuse to the proper location on the printed circuit board.
5. Insert the fuse cap holder by pushing the cap straight into it's holder on the printed circuit board.

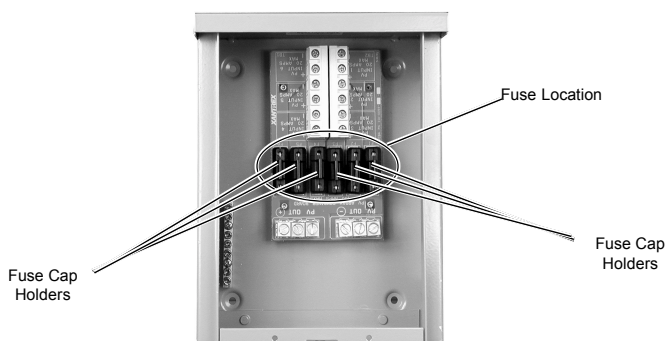


Figure 6
Removing/Replacing the Fuses

Voltage Drop

All wiring should be sized for sufficient ampacity as determined by the National Electrical Code (NEC). In addition, wire sizes may need to be increased beyond the NEC requirements to prevent excessive voltage drop. The percentage of voltage drop depends on the system voltage, solar module current, wire length, and wire gauge. The combined voltage drop over the TCB 6 input and output wires should be no more than 3%. Often the voltage drop is kept below 1% on the combiner box input wiring and below 2% on the combiner box output wiring, but this is up to the system designer. In systems which include maximum power point tracking, decreased voltage corresponds directly with decreased power, so voltage drop should be kept as low as possible, often as low as 1%.

Wiring



NOTE: *There are six output terminals on the bottom of the combiner board (three negative, three positive). Two terminals allow for paralleling multiple TCB 6 combiner boxes in installations which require more than six fused circuits, as long as the maximum current is below 100 amps combined. Refer to Figure 8.*

1. Install the conduit or strain relief fittings for the input and output wiring.
2. Identify the wiring pair for the first input source circuit.
 - a. Strip the insulation of the negative (-) wire back to approximately 0.250" and insert into one of the negative (-) PV input terminal blocks.
 - b. Torque the terminal block to 5-10 in-lbs.
 - c. Strip the insulation of the positive (+) wire back by approximately 0.250" and insert into the positive (+) PV input terminal block next to the negative wire installed in step 2a.
 - d. Torque the terminal block to 5-10 in-lbs.
3. Repeat step 2 for each of the other input source circuits.
4. Strip the insulation of the negative PV output cable back by approximately 0.5" and insert into the negative (-) PV output terminals.
 - a. Torque the setscrew to 120 in-lbs.
5. Strip the insulation of the positive PV output cable back by approximately 0.5" and insert into the positive (+) PV output terminals.
 - a. Torque the setscrew to 120 in-lbs.



NOTE: *Triple- output lugs are provided allowing use of parallel configurations. See Figure 8.*

6. Connect equipment ground wires to the equipment ground bus.
7. Verify the correct wiring of all the PV input, PV output and ground connections.
8. Install the correct sized fuses as described on page 7.
9. Install the cover of the TCB 6 and fasten with the supplied hardware.

2.0 INSTALLATION

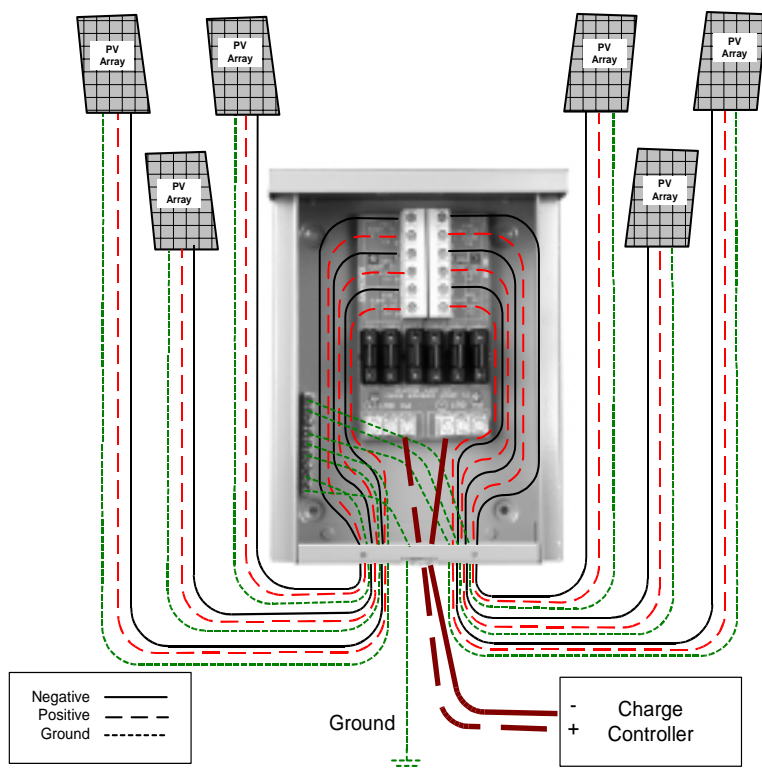


Figure 7
Wiring Diagram

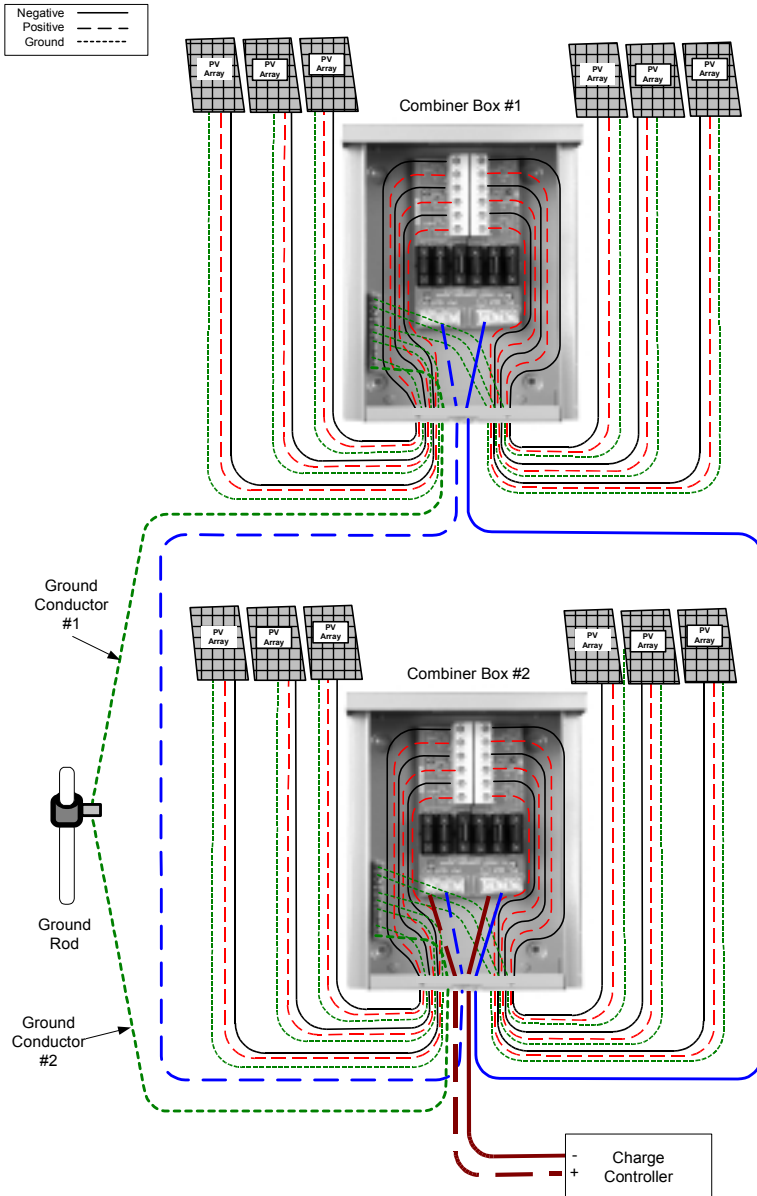


Figure 8
Wiring Diagram - Parallel Configuration



NOTE: Wires installed in accordance with NEC Article 250. Both Ground Conductors shall be cut of the same length and gauge.

2.0 INSTALLATION

Installation Notes

3.0 Service Information

Xantrex Technology Inc., takes great pride in its products and makes every effort to ensure that your unit fully meets your independent powering needs.

If your product needs repair, contact our Customer Service department at: (360) 435-8826 to obtain an RMA# and shipping information; or, fax this page with the following information to: (360) 474-0616. You can also contact the Xantrex Warranty Department at Tracewarranty@traceengineering.com.

Please provide:

Model Number: _____

Serial Number: _____

Purchase Date: _____

Problem: _____

Include a telephone number where you can be reached during business hours and a complete return shipping address (P.O. Box numbers are not acceptable).

Name: _____

Address: _____

City: _____

State / Province: _____

Zip / Postal Code: _____

Country: _____

Phone: (____) _____

FAX: (____) _____

E-mail Address: _____



visit our website at: www.xantrex.com

or e-mail us at: Tracewarranty@traceengineering.com

3.0 SERVICE INFORMATION

4.0 Warranty

Xantrex Technology Inc., warrants its power products against defects in materials and workmanship for a period of two (2) years from the date of purchase, established by proof of purchase or formal warranty registration, and extends this warranty to all purchasers or owners of the product during the warranty period. Xantrex does not warrant its products from any and all defects:

- arising out of material or workmanship not provided by Xantrex or its authorized Service Centers;
- when the product is installed or exposed to an unsuitable environment as evidenced by generalized corrosion or biological infestation;
- resulting from abnormal use of the product, alteration, or use in violation of the instructions;
- in components, parts, or products expressly warranted by another manufacturer.

Xantrex Technology Inc., agrees to supply all parts and labor to repair or replace defects covered by this warranty with parts or products of original or improved design, at the company's option. Xantrex Technology Inc., also reserves the right to improve the design of its products without obligation to modify or upgrade those previously manufactured. Defective products must be returned to Xantrex Technology Inc., or its Authorized Service Center in the original packaging or equivalent. The cost of transportation and insurance on items returned for service is the responsibility of the customer. Return transportation (UPS Ground or equivalent) as well as insurance on all repaired items is paid by Xantrex Technology Inc.

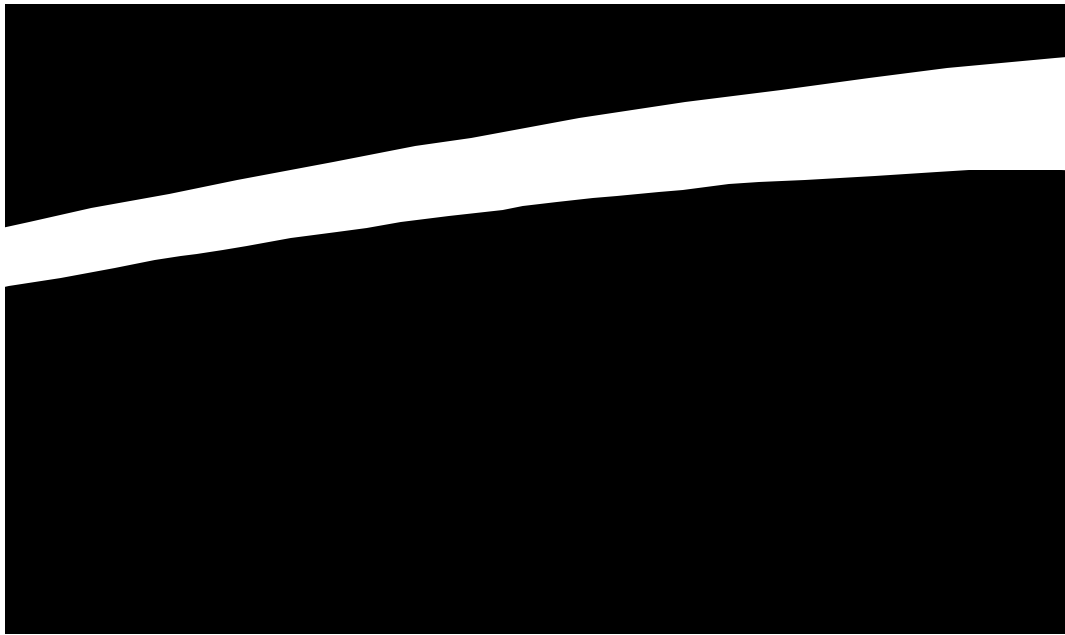
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