

Solar radiation Calibrated cell

User manual



Revisions list

<i>Issue</i>	<i>Date</i>	<i>Description of changes</i>
Origin	14/06/2023	
1	28/08/2024	Added Modbus information and PRRDA4050 sensor schematic drawing; corrected some commercial codes

About this manual

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1 Introduction

PRRDA4001, PRRDA4030 and PRRDA4050 are sensors that measure natural solar radiation. The type of sensor is useful in evaluating the behavior and efficiency of photovoltaic modules.

2 Technical specifications

Order number	PRRDA4001	PRRDA4030	PRRDA4050
Output	~85 mV/1500 W/m ² @25°C	4±20 mA	RS-485
Accuracy	±0.3 ±5% (0÷100 W/m ²) ±0.2 ±5% (100÷1500 W/m ²)	±4.5 ±2% (0÷100 W/m ²) ±3 ±2% (100÷1500 W/m ²)	±2 ±2% (0÷100 W/m ²) ±1 ±2% (100÷1500 W/m ²)
Offset	0 W/m ²	2.2 W/m ²	1 W/m ²
Response time	0.001 s	0.15 s	1 s
Temperature dependency (-35÷80°C)	3%	0.4 %	
Power supply	-	12÷28 V CC	
Cable	Shielded (L=3 m)	Shielded (L=3 m) + connector for DWA5xxA cables	
Data logger compatibility	E-Log	E-Log	Alpha-Log

Common technical specifications

Solar radiation	Technology	Monocrystalline
	Range	0 ÷1500 W/m ²
	Stability per year	0.5%
	Nonlinearity	0.1%
General information	Housing	Aluminium powder coating
	Weight / Dimensions	0.4 kg / 155 mm x 85 mm x 39 mm
	Fixing	Lateral holes Ø 6.5 mm; 8.5 mm e 6.5 mm
	Protection grade	IP65
	Operative temp.	-35÷80°C
	Mounting	Mast Ø 48÷50 mm
	Material	Embedded in Ethylene-Vinyl-Acetate (EVA) between glass and Tedlar

3 Report of Calibration

The calibration of every sensor is achieved by a reference element from an accredited test laboratory. The solar cell is embedded in Ethylene-Vinyl-Acetate (EVA) between glass and Tedlar and integrated in a powder-coated aluminum housing. The construction of the sensor is comparable to that of a standard PV module. A calibrating printout (similar to EN DIN 17025) reports the product specific parameters.

It is not necessary to re-calibrate the instrument frequently. However, it is recommended to do it every 2 years.

4 Installation

For installation, take the following into account:

- Sensors used for monitoring of PV installations must be installed with the same alignment and inclination as the PV generator.
- The mounting location should be free of shading as far as possible.
- To facilitate maintenance and cleaning of the sensor, the sensor should be mounted in an easily accessible place.
- The mounting location at a PV generator must be selected such that snow cannot jeopardise the sensor as it slides off. For this reason, do not mount along the drip edge on the PV generator.
- The connecting cable should always be laid separated from, e.g. main DC cables or AC cables.
- The connecting cable is to be laid so it is fixed.
- The minimum bending radius of 15 x cable diameter (\varnothing approx. 5 mm) is to be observed.
- The voltage drop at the cable has to be considered when calculating the maximum cable length.
- The pressure equalisation element must not be damaged.
- The cable gland is not allowed to be undone or tightened by the user.
- The surge protection concept must be adapted to the specific local situation. This means, for instance, that the measuring cables must be equipped with a separate surge arrester at the entry to a building.
- The sensor must be integrated into the lightning protection concept.
- The sensors are designed for safety extra-low voltage (SELV) operation. Reversing the polarity or mixing up the connections on the Si sensor may cause irreversible damage to the sensor.
- The cable shield is to be connected to PE during installation.

4.1 General safety rules

Please read the following general safety rules in order to avoid injuries to people and prevent damages to the product or to possible other products connected with it. In order to avoid any damages, use this product exclusively according to the instructions herein contained.

The installation and maintenance procedures must be carried-out only by authorized and skilled service personnel.

Power the instrument in a suitable manner. Pay attention and observe the power supplies like indicated for the model in your possession.

Carry-out all connections in a suitable manner. Pay strict attention to the connection diagrams supplied with the instrument.

Do not use the product in case of suspected malfunctions. In case of suspected malfunction, do not power the instrument and contact authorized technical support immediately.

Before you carry-out any operation on electrical connections, power supply system, sensors and communication apparatus:

- Disconnect the power supply.
- Discharge the accumulated electrostatic discharges touching an earthed conductor or apparatus.

For safety regulations please refer to manual INSTUM_05290.

4.2 Electrical connection

Wiring connections must be performed as reported in the DISACC210045 (see ANNEX 1).

4.3 Calibration factor

Measurement obtained by the sensor signal output, in voltage or in current depending on the model, must be multiplied, on the data acquisition system, by the Calibration factor, this is to obtain the most accurate radiation value results.

Example

Measurement range: 0÷1500 Wm⁻²
Electrical output: 4÷20 mA
Wm⁻² each mA: 1500 / 16 = 93,75 Wm⁻²/mA
Calibration factor: 0,96 (value reported on the Report of Calibration)

Electrical output from the measuring sensor: 10 mA (ad esempio)
Corresponding radiation value: 10 – 4 = 6 mA * 93,75 = 562,5 Wm⁻²
Radiation value considering the calibration factor: 562,5 Wm⁻² * 0,96 = 540 Wm⁻²

4.4 Use with LSI LASTEM data logger

If the sensor is used with an LSI LASTEM data logger, proceed with the configuration of the data logger using the 3DOM software:

- Open the data logger configuration.
- Add the sensor by selecting its code (PRRD4001) from the *3DOM Sensor Library*.
- Check the acquisition parameters (input, rate, etc.)
- Save the configuration and send it to the data logger.

For more information about the configuration, refer to the manual of the data logger in use.

5 Modbus

The PRRDA4050 sensor supports the Modbus RTU protocol.

The command for reading the measures is ReadHoldingRegister (0x03).

The Modbus address is 1.

The communication parameters are:

- Speed: 9600 bps
- Parity: None
- Data bits: 8
- Stop bits: 1

The map of the registers is as follows:

Measure name	Measure unit	Address (hex)	Data type	Scaling factor
Global radiation	W/m ²	0	UInt16	10
Cell temperature	'C	7	UInt16	10

The read measure must be divided by the scaling factor.

6 Operational check

To check the sensor output it is necessary to have the accompanying drawing (DISACC) of the sensor and a multimeter.

Identify the sensor output: voltage or current. Proceed as follows:

- For sensors with direct voltage output signal (μV):
 1. Set the multimeter to measure voltage signals and scale in μV .
 2. Connect the red test lead (+) of the multimeter to the wire corresponding to the positive signal (+ Sig) and the black test lead (-) to the negative signal wire (- Sig) of the sensor (it is not necessary to disconnect the sensor from the data logger.)
 3. Darken the sensor with a black cloth; the multimeter should measure around 0 μV .
 4. With the sensor exposed to the sun the multimeter should measure a value greater than 0 μV .
- For sensors with 4÷20 mA current output signal:
 1. Set the multimeter to measure signals in direct current (DC) and 20 mA scale.
 2. Disconnect the wire corresponding to the negative signal (- Sig) and connect it to the red test lead (+) of the multimeter. The black test lead (-) fix it in place of the disconnected wire.
 3. Darken the sensor with a black cloth; the multimeter should measure approximately 4 mA.
 4. With the sensor exposed to the sun the multimeter should measure a value greater than 4 mA.

Verification of the digital output (RS485) can be done using a PC, equipped with a suitable serial port and in which the third-party modpoll program (<https://www.modbusdriver.com/modpoll.html>) is installed.

1. Connect the sensor serial cable to the PC serial port.
2. Open a DOS Prompt window and type the following command (it is assumed that the transmission parameters are set as follows: *Baudrate: 9600 bps, Parity: None* and that the PC serial port used is COM1):

```
modpoll -a 1 -r 1 -c 1 -t 3:float -p none -b 9600 -p none com1 [Enter]
```

For the list of available commands, type the command *modpoll /help*.

3. Darken the sensor with a black cloth; you should read 0 as value displayed by the program.
4. With the sensor exposed to the sun, a value greater than 0 should be read as the value displayed by the program.

7 Maintenance

The sensor requires no special maintenance, just wiping with a damp cloth to keep the cells clean, once or twice a week, depending on where it is installed. It is also advisable to check the integrity and the stability of the sensor.

For calibration, refer to §3.

8 Handling

Avoid the introduction of electrostatic discharge (ESD). The product, or part of it, is fragile, avoid mechanical shocks, abrasions or scratches on the surface and dome.

9 Storage, packaging, preservation, delivery

For storage, respect the humidity (10÷100% non-condensing) and temperature (-35÷80 °C) limits. Avoid direct sun exposure.

For delivery and storage, use the packaging supplied with the product.

For preservation, it is recommended to respect the environmental limits of humidity (15÷80% non-condensing) and temperature (-10÷50 °C).

Upon receipt of the material, visually check the package for signs of crushing or perforation; in the presence of these signs, check the integrity of the product inside.

10 Disposal

This product is a device with high electronic content. In accordance with the standards of environmental protection and collection, LSI LASTEM recommends handling the product as waste of electrical and electronic equipment (RAEE). For this reason, at the end of its life, the instrument must be kept apart from other wastes.

LSI LASTEM is liable for the compliance of the production, sales and disposal lines of this product, safeguarding the rights of the consumer. Unauthorized disposal of this product will be punished by the law.



Recycle or dispose of the packaging material according to local regulations.

11 Accessories and spare parts

Order number	Description
DYA060	Lateral fixing arm for cell installation on PV module
DWA505A	Cable L=5 m
DWA510A	Cable L=10 m
DWA525A	Cable L=25 m
DWA526A	Cable L=50 m

12 How to contact LSI LASTEM

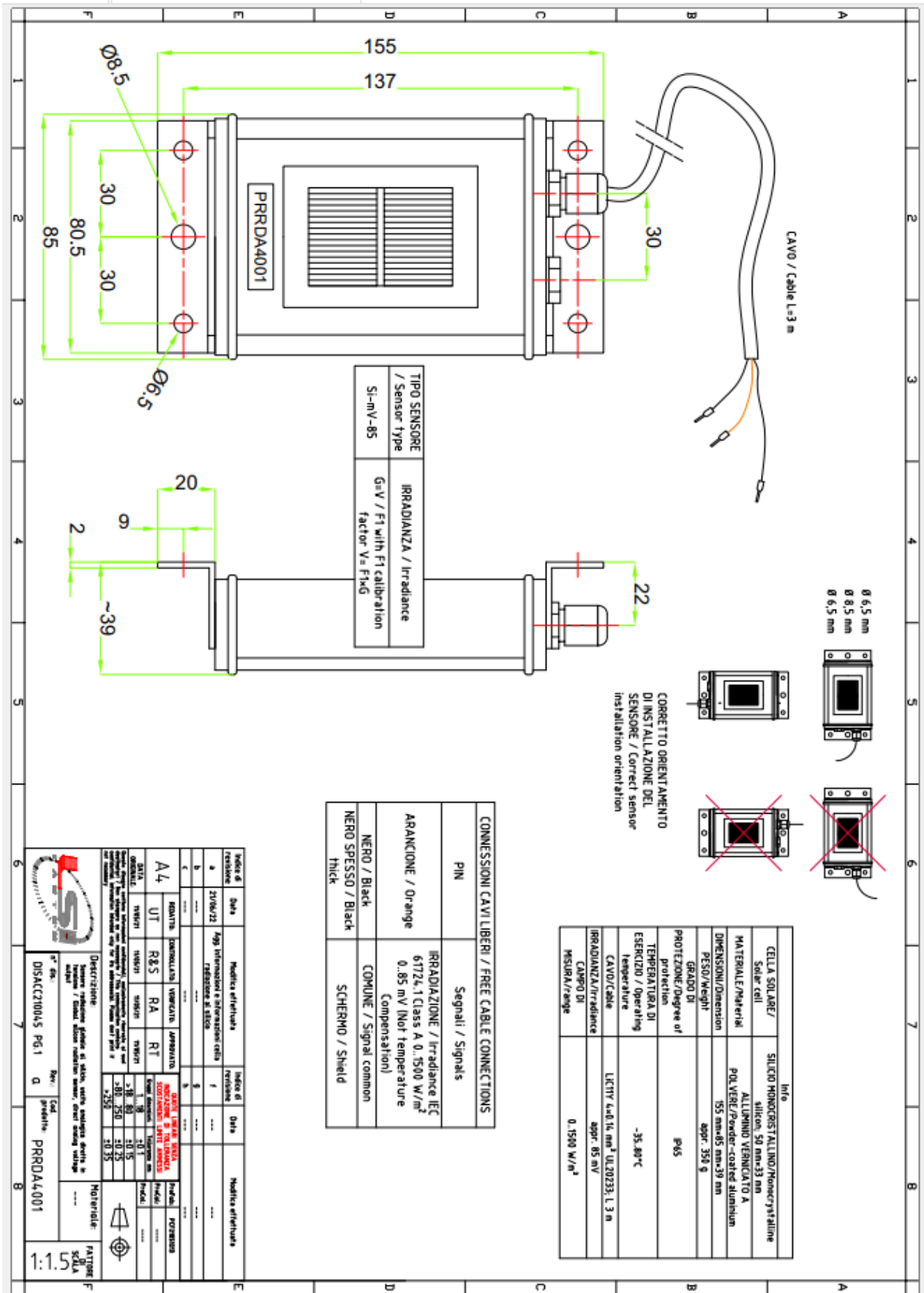
In case of problem contact the technical support of LSI LASTEM sending an e-mail to support@lsi-lastem.com, or compiling the technical support request module at www.lsi-lastem.com.











For further information refer to addresses and numbers below:

- Phone number +39 02 95.414.1 (switchboard)
- Address: Via ex S.P. 161 – Dosso n. 9 - 20049 Settala Premenugo, Milano
- Web site: www.lsi-lastem.com
- Commercial service: info@lsi-lastem.com
- After-sales service: support@lsi-lastem.com, Repairs: riparazioni@lsi-lastem.com

13 ANNEX 1

13.1 PRRDA4001 sensor schematic drawing



<p>A</p> 	<p>I SENSORI DI RADIAZIONE GLOBALE AL SILICIO UTILIZZATI PER IL MONITORAGGIO DEGLI IMPIANTI FOTOVOLTAICI DEVONO ESSERE INSTALLATI CON LO STESSO ALLINEAMENTO E LA INCLINAZIONE DEL PANNELLO FOTOVOLTAICO. LA POSIZIONE DI INSTALLAZIONE DEVE ESSERE ESEGUITA IN UNA POSIZIONE SOLEGGIATA. PER FACILITARE LA MANUTENZIONE E LA PULIZIA DEL SENSORE, ESSO DEVE ESSERE MONTATO IN UN LUOGO FACILMENTE ACCESSIBILE (AD ESEMPIO VICINO A FINESTRE O LUCERNARI) / SI sensors used for monitoring of PV installations must be installed with the same alignment and inclination as the PV generator. The mounting location should be free of shading as far as possible. To facilitate maintenance and cleaning of the SI sensor, the SI sensor should be mounted in an easily accessible place (e.g. near roof windows or skylights)</p>		<p>LA POSIZIONE DI MONTAGGIO DELLA CELLA FOTOVOLTAICA DEVE ESSERE SELEZIONATA IN MODO TALE CHE LA NEVE NON POSSA METTERE A REPERTAGLIO IL SENSORE. NON INSTALLARE LUNGO IL BORDO DEL PANNELLO FOTOVOLTAICO / The mounting location of a PV generator must be selected such that snow cannot jeopardise the SI sensor as it slides off. For this reason do not mount along the drip edge on the PV generator.</p>		<p>IL CAVO DI COLLEGAMENTO DEVE ESSERE POSATO SEPARATAMENTE DAL SENSORE IN MODO TALE CHE RISULTI FISSO E INDIPENDENTE VA OSSERVATO IL RAGGIO DI CURVATURA MINIMO DI 5mm x DIAMETRO DEL CAVO (CAVO Ø=5mm). LA CADUTA DI TENSIONE AL CAVO DEVE ESSERE CONSIDERATA QUANDO SI CALCOLA LA LUNGHEZZA MASSIMA DEL CAVO / The connecting cable should always be laid separated from, e.g. main DC cables or AC cables. The connecting cable is to be laid so it is fixed. The minimum bending radius of 5 x cable diameter (approx. 5 mm) is to be observed. The voltage drop at the cable has to be considered when calculating the maximum cable length.</p>	<p>B</p>
	<p>L'ELEMENTO DI COMPENSAZIONE DI PRESSIONE NON DEVE ESSERE DANNEGGIATO. IL PRESSACAVO NON DEVE ESSERE ALLENTATO O SERRATO DALL'UTENTE. NON E' NECESSARIO CHE L'INSTALLATORE O L'UTENTE APRA IL SENSORE. SE L'ALLOGGIAMENTO VIENE COMUNQUE APERTO, NON SARANNO ACCETTATE RESPONSABILITA' SU UNA POSSIBILE RIDUZIONE DELLA TENUTA STAGNA DELLA SIGILLATURA / The pressure equalisation element must not be damaged. The cable gland is not allowed to be undone or tightened by the user. It is not necessary for the installer or user to open the SI sensor. If the housing is nevertheless opened, no liability for the sealing can be accepted.</p>		<p>IL CONCETTO DI PROTEZIONE CONTRO LE SOVRATENSIONI DEVE ESSERE ADATTATO ALLA SITUAZIONE LOCALE SPECIFICA. CIO' SIGNIFICA, AD ESEMPIO, CHE I CAVI DI MISURA DEVONO ESSERE DOTATI DI UN SCARICATORE DI SOVRATENSIONE SEPARATO. IL SENSORE DEVE ESSERE INTEGRATO NELL'IMPIANTO DI PROTEZIONE CONTRO I FULMINI / The surge protection concept must be adopted to the specific local situation. This means, for instance, that the measuring cables must be equipped with a separate surge arrester at the entry to a building. The sensor must be integrated into the lightning protection concept</p>		<p>I SENSORI SONO PROGETTATI PER IL FUNZIONAMENTO DI SICUREZZA A BASSISSIMA TENSIONE (SELV). INVERTIRE LA POLARITA' O VARIARE LE CONNESSIONI SUL SENSORE PUO' CAUSARE DANNI IRREVERSIBILI AL SENSORE. LA SCHEMATURA DEL CAVO DEVE ESSERE COLLEGATA A TERRA DURANTE L'INSTALLAZIONE / The sensors are designed for safety extra-low voltage (SELV) operation. Reversing the polarity or mixing up the connections on the SI sensor may cause irreversible damage to the sensor. The cable shield is to be connected to PE during installation.</p>	<p>C</p>
	<p>L'INSTALLAZIONE E L'ASSEMBLAGGIO DI MATERIALE ELETTRICO DEVONO ESSERE ESEGUITI DA PERSONE QUALIFICATE. IL SENSORE NON PUO' ESSERE UTILIZZATO CON APPARECCHIATURE IL CUI SCOPO DIRETTO O INDIRETTO E' QUELLO DI PREVENIRE LA MORTE O LESIONI UMANE O IL CUI FUNZIONAMENTO RAPPRESENTA UN RISCHIO PER L'UOMO, GLI ANIMALI O LA PROBIOTTA' / The installation and assembly of electrical equipment must be carried out by electrically qualified persons. The sensor may not be used with equipment whose direct or indirect purpose is to prevent human death or injury, or whose operation poses a risk to humans, animals or property.</p>		<p>PERICOLO MORTALE DOVUTO ALL'ALIMENTAZIONE ELETTRICA SUL COLLEGAMENTO DEL SENSORE A UN INVERTER. SONO PRESENTI TENSIONI PERICOLOSE SULL'INVERTER (DISCONNESSIONE, SICUREZZA CONTRO LA COMMUTAZIONE, SEGUIRE IL MANUALE DELL'INVERTER) / Mortal danger due to electrical power on the connection of the SI sensor to an inverter, dangerous voltages are present on the inverter (disconnection, secure against switching, follow inverter manual).</p>		<p>SE RISULTA NECESSARIO PULIRE IL SENSORE, E' POSSIBILE UTILIZZARE UN PANNO DI COTONE MORBIDO, ACQUA E UN DETERGENTE DELICATO PER QUESTO SCOPO / Should it be necessary to clean the SI sensor, a soft cotton cloth, water and a mild cleaning agent can be used for this purpose</p>	<p>D</p>
	<p>Indice di revisione</p>	<p>Data</p>	<p>Medicina aziendale</p>	<p>Indice di revisione</p>	<p>Data</p>	<p>Medicina aziendale</p>
<p>1</p>	<p>2</p>	<p>3</p>	<p>4</p>	<p>5</p>	<p>6</p>	<p>7</p>
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<p>1</p>	<p>2</p>	<p>3</p>	<p>4</p>	<p>5</p>	<p>6</p>	<p>7</p>
<p>1</p>	<p>2</p>	<p>3</p>	<p>4</p>	<p>5</p>	<p>6</p>	<p>7</p>
<p>1</p>	<p>2</p>	<p>3</p>	<p>4</p>	<p>5</p>	<p>6</p>	<p>7</p>
<p>1</p>	<p>2</p>	<p>3</p>	<p>4</p>	<p>5</p>	<p>6</p>	<p>7</p>
<p>1</p>	<p>2</p>	<p>3</p>	<p>4</p>	<p>5</p>	<p>6</p>	<p>7</p>
<p>1</p>	<p>2</p>	<p>3</p>	<p>4</p>	<p>5</p>	<p>6</p>	<p>7</p>
<p>1</p>	<p>2</p>	<p>3</p>	<p>4</p>	<p>5</p>	<p>6</p>	<p>7</p>
<p>1</p>	<p>2</p>	<p>3</p>	<p>4</p>	<p>5</p>	<p>6</p>	<p>7</p>
<p>1</p>	<p>2</p>	<p>3</p>	<p>4</p>	<p>5</p>	<p>6</p>	<p>7</p>
<p>1</p>	<p>2</p>	<p>3</p>	<p>4</p>	<p>5</p>	<p>6</p>	<p>7</p>
<p>1</p>	<p>2</p>	<p>3</p>	<p>4</p>	<p>5</p>	<p>6</p>	<p>7</p>
<p>1</p>	<p>2</p>	<p>3</p>	<p>4</p>	<p>5</p>	<p>6</p>	<p>7</p>
<p>1</p>	<p>2</p>	<p>3</p>	<p>4</p>	<p>5</p>	<p>6</p>	<p>7</p>
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<p>1</p>	<p>2</p>	<p>3</p>	<p>4</p>	<p>5</p>	<p>6</p>	<p>7</p>
<p>1</p>	<p>2</p>	<p>3</p>	<p>4</p>	<p>5</p>	<p>6</p>	<p>7</p>
<p>1</p>	<p>2</p>	<p>3</p>	<p>4</p>	<p>5</p>	<p>6</p>	<p>7</p>
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<p>1</p>	<p>2</p>	<p>3</p>	<p>4</p>	<p>5</p>	<p>6</p>	<p>7</p>
<p>1</p>	<p>2</p>	<p>3</p>	<p>4</p>	<p>5</p>	<p>6</p>	<p>7</p>
<p>1</p>	<p>2</p>	<p>3</p>	<p>4</p>	<p>5</p>	<p>6</p>	<p>7</p>
<p>1</p>	<p>2</p>	<p>3</p>	<p>4</p>	<p>5</p>	<p>6</p>	<p>7</p>
<p>1</p>	<p>2</p>	<p>3</p>	<p>4</p>	<p>5</p>	<p>6</p>	<p>7</p>
<p>1</p>	<p>2</p>	<p>3</p>	<p>4</p>	<p>5</p>	<p>6</p>	<p>7</p>
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<p>1</p>	<p>2</p>	<p>3</p>	<p>4</p>	<p>5</p>	<p>6</p>	<p>7</p>
<p>1</p>						

