Smart Solar Cell Stringers: Enabling the Future of Solar Module Manufacturing

Hangzhou ConfirmWare Technology Co., Ltd.

Content

About ConfirmWare

Established in 2005, Hangzhou ConfirmWare Technology Co., Ltd. is a national high-tech enterprise, specializing in R&D and manufacturing of smart equipment.

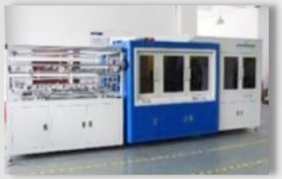
Launched the first generation stringer in 2011, ConfirmWare is one of the earliest enterprises engaged in R & D and manufacturing of PV module equipment in China.

- Projects are spread in **20+** countries and regions around the world.
- Products have passed **CE, CSA, UL** and other certifications
- over **500+** professional employees
- **over 200+** patents and intellectual property rights
- Through **ISO9001 and ISO14001**
- **30000㎡** production base and **3000㎡** R&D lab

Milestones and Technological Breakthroughs

CONFIRMWARE

Always keeping up with cutting-edge technology !



Launched the Gen1 of AST1200 stringer

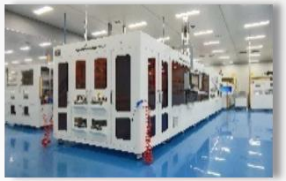
2011

First module production line is in operation

2017

IBC Stringer *ICA-3000-I*

2019



High speed MBB stringer *AMS070A* / Non-destructive Cutting Machine *ULC-8000*

2021

Zero busbar stringer *AZS70CA*
Ultra High-Speed Stringer with Inline NDC *AMS100CA*

2023

2015

Strategic cooperation with Hikvision

HIKVISION 海康威视

2018

Shingled stringer *KFW I-SL* MBB stringer *AMS-4000*

2020

Conductive Film Adhesive Stringer

2022

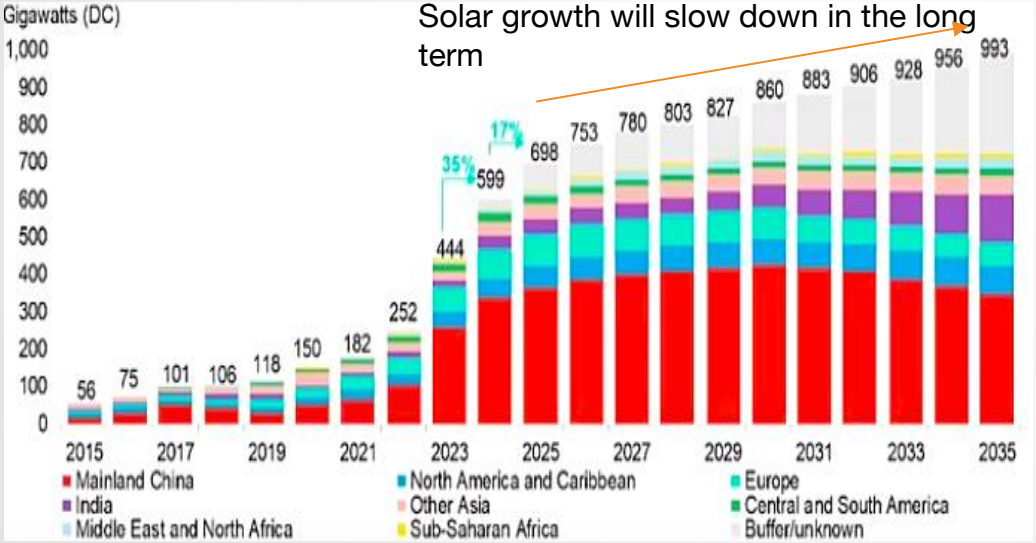
Stringer and layup bussing machine *AMS070LA*

2024

BC Stinger ABS70A
Ultra High-Speed Stringer with Inline NDC AMS120CA

Global annual solar installations to grow another 17% in 2005

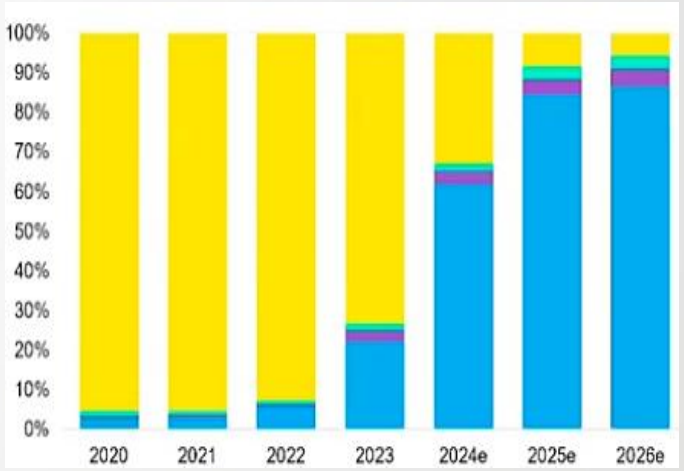
Historical and forecast global solar capacily additions



Source: BloombergNEF

TOPCon to remain mainstream cell technology for at least two years

Market share of different silicon solar cell fechnologies



Source: BloombergNEF

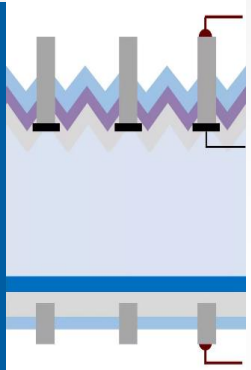
Technology Challenges

CONFIRMWARE

1

Compared with traditional P-type cells, N-type cells have advantages such as higher conversion efficiency, higher double-sided rate, lower temperature coefficient, no light-induced degradation, better weak light performance, and longer carrier lifetime.

These cells are more sensitive to temperature during the welding process.

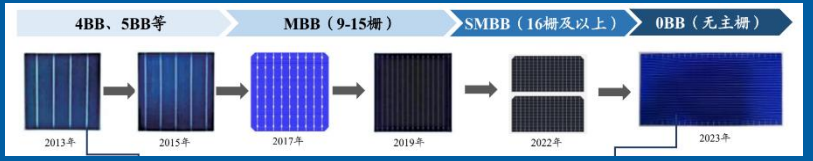


2

Traditional P-type cell: 3BB-12BB
Traditional N-type cell: 9BB-24BB-280BB-0BB

Increased welding difficulty

- Increased number of busbar
- Reduced amount of silver paste
- Smaller pads or no pads

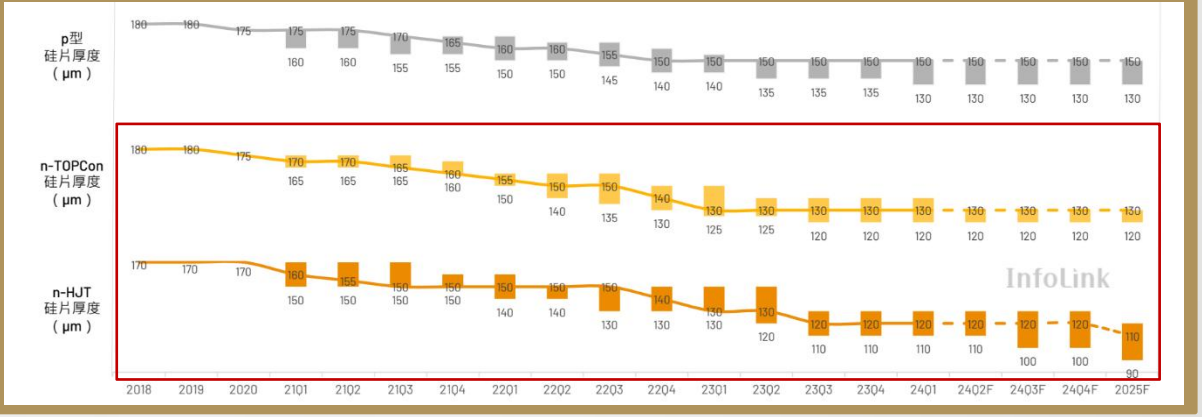


3

N-type silicon wafers with a thickness of 120μm has reached mass production
The ability to mass-produce HJT 90μm wafers has been achieved.

Wafer thinning has become a trend.

Wafer Thickness Trends



Smart Solar Cell Stringers

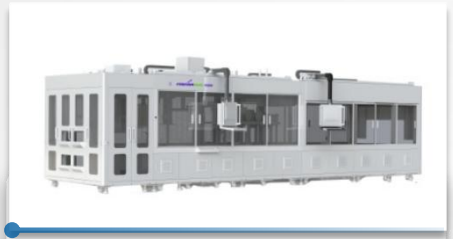
CONFIRMWARE

For 15 years, ConfirmWare has been specializing in the stringer's R&D.

Ultra High Speed MBB Cell Stringer with Inline NDC

AMS120CA / AMS100CA / AMS070CA

- **Cycle:12000pcs/h**
  10000pcs/h, 7200pcs/h
- Yield of Soldering ≥98.5%
- Soldering Mode: IR soldering
- Cell Specification:1/2 or 1/3 cells etc.
  100μm-200μm, 9BB-24BB



Zero Busbar Stringer

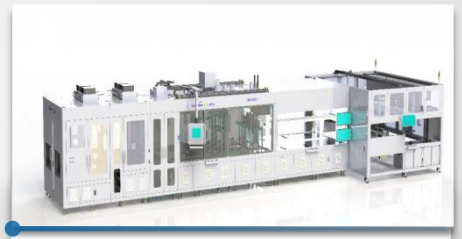
AMS100PA / AMS100CA

- Cycle:9000pcs/h
- Modular design, supports various 0BB flexible interconnection solutions.
- Cell Specification:182-230mm,
  1/2 or 1/3 cells etc., 90μm-200μm,
  9BB-28BB

High Speed BC Stringer

ABS120CA

- Cycle:12000pcs/h
- Including loading, solder paste printing and curing, Insulating Adhesives printing and curing , cutting , stringing and inspection.
- Ribbon Size: Round wire/Flat ribbon
- It is compatible with TBC, HBC, etc.



Auto Stringer and Layup bussing machine(4 in 1)

AMS120LA / AMS100LA

- Cycle:57.6s/module(12pcs/string)
- Non-destructive cutting machine, Cell Stringer, Layup Machine and Bussing Machine are highly integrated.
- Saving space and improve utilization.
- Lowering the crack risk
- Convenient for commissioning.
- High cost-effective

*Separate Cell Stringer and laser cutting machine are optional

Zero Busbar Cell Interconnection Technology Comparison

CONFIRMWARE

Process Flow

Route1： *Adhesive-Screen-Printing and curing*

1. *Adhesive Screen-Printing*
2. *Ribbon treatment*
3. *UV Curing*
4. *Layup ,bussing and EVA*
5. *Lamination*

HJT

Route2： *Infrared Welding, then Adhesive-Screen-Printing*

1. *Infrared welding*
2. *Front-Side Adhesive Printing & Curing (String)*
3. *Cell String Flip-Over*
4. *Back-Side Adhesive Printing & Curing (String)*
5. *String EL Inspection*

HJT TOPCon

Route3： *Adhesive-Screen-Printing, then Infrared Welding*

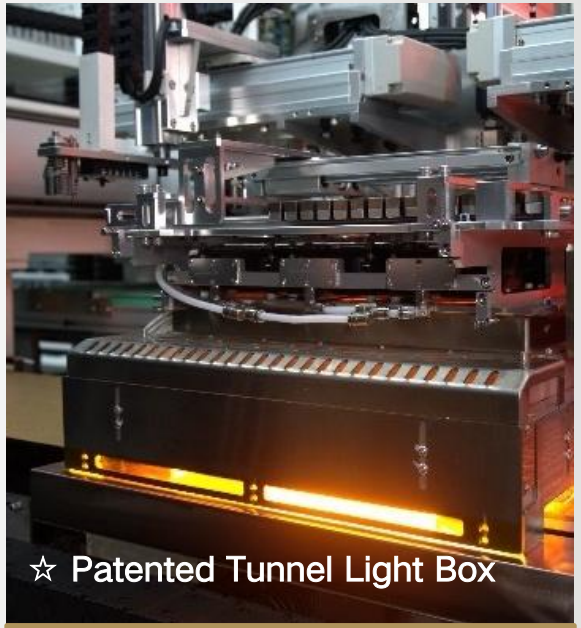
1. *Adhesive Screen-Printing*
2. *Ribbon treatment*
3. *UV Curing*
4. *Infrared welding*
5. *String EL Inspection*

HJT TOPCon

Core Performance Improvement, Better Adaptation to N-type Modules

High welding yield | Excellent compatibility

- Tunnel-type light box, high precision temperature control system
- AI temperature control algorithm, adaptive adjustment
- Good temperature consistency inside the light box and uniform heating of the cells

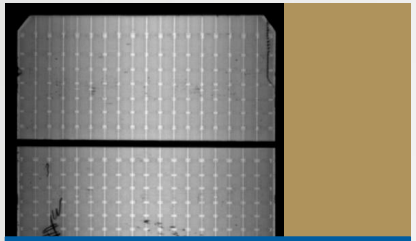


☆ Patented Tunnel Light Box

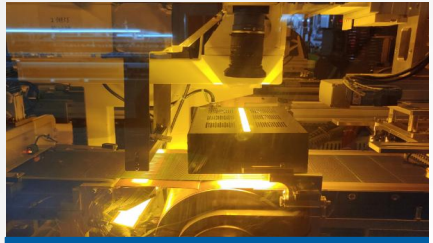
Fully applied to our mass-produced AMS60A and AMS100CA models in June 2022

Yield Control—Process Control

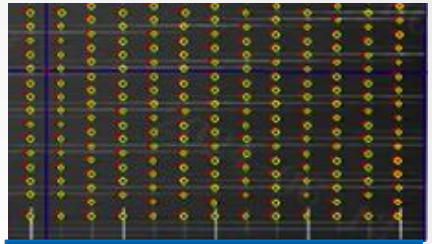
CONFIRMWARE



Cell PL Inspection



String Front and Back Appearance Inspection



Glue dot inspection

String EL Detection

High Stability—Structural advantages

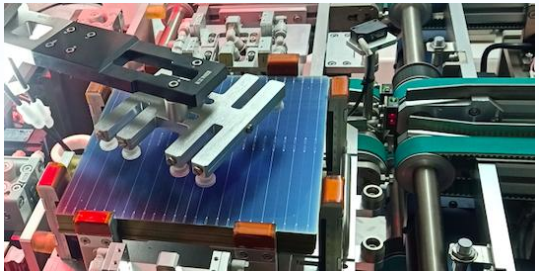
CONFIRMWARE

High Precision Ribbon Handling System

- Vertical jaws and innovative Gripper
- Integral tooling to prevent shifting
- The traction mechanism reduces the running distance, precise positioning and controls the whole process.

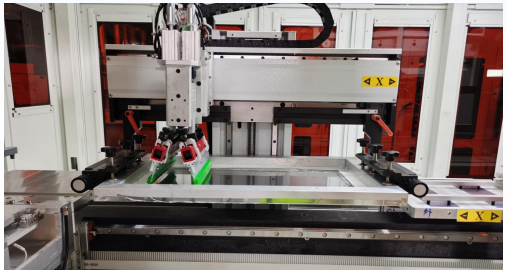
Flexible Conveyor Systems

- High-density sucker, sponge sucker
- Grips more gently and prevents crack
- Non-telescoping belt for precise



Adhesive Screen-Printing stabilization

- Adopting suspended steel plate printing technology to avoid cell cracks
- Suitable for different types of glue
- High precision，controllable



Intelligent Control—AI Self-Diagnostic System

CONFIRMWARE

- *Parameter Adaptive Adjustment*
  ex. Welding power，temperature compensation
- *Pre-warning of malfunctions*
- *Malfunction diagnosis*

Negative feedback, PLC self-regulation

EL Diagnostic Result
Air pressure
Jaw speed
Flux level
Light box temperature
internal temperature
Plate temperature

01 **Data Detection**

PLC Protocol

02 **SQLUTE Databases**

Light box temperature data sheet,
Barometric Pressure Size Datasheet
EL Diagnostic Data Sheet .....

ODBC

03 **Diagnostic Models**

- *Segmenting multiple data samples*
- *Data Normalization and Labeling*
- *Divide training, validation, and test samples*
- *Using the Transformer/LSTM model, the model is trained by a training set and validated by a validation set*
- *Test sets for data fail diagnosis*
- *Multiple parameter adjustments. Optimizing the model*
- *Output diagnostic results*

04 **Diagnostic Result**

Results visualization, parameter adjusted data

High Compatibility

CONFIRMWARE

Technology Extensibility

- **Conventional stringer are compatible with the 0BB flexible interconnection solutions process**
- Standard data interface is available to facilitate the access to plant MES system.

Easy Switching and Convenient Maintenance

- Simple structure and modular design of equipment facilitate switching.
- Switching of cells with different busbar spacings can be accomplished by 2 people within 4 hours and can be produced quickly and stably.

Process Compatibility

CELL

182-230mm

9BB-28BB

90-200μm(PERC 130-200μm)

PERC / TOPCon / HIT / xBC

RIBBON

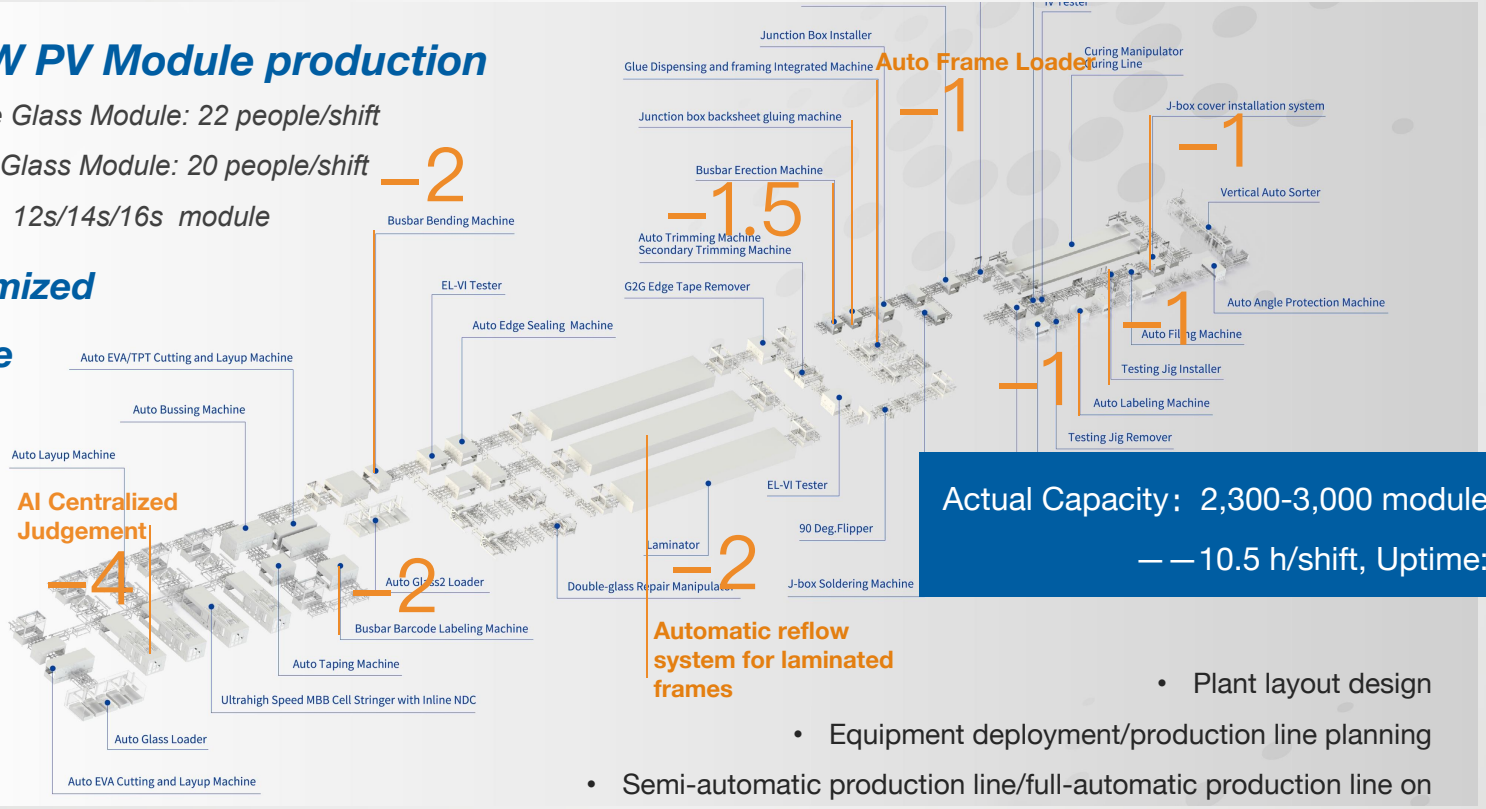
Compatible with φ0.2-φ0.32mm

■ High Automation and Minimized Operator

1.2 GW PV Module production line

- *Double Glass Module: 22 people/shift*
- *Single Glass Module: 20 people/shift*
- *Cycle：12s/14s/16s module*

Customized Service



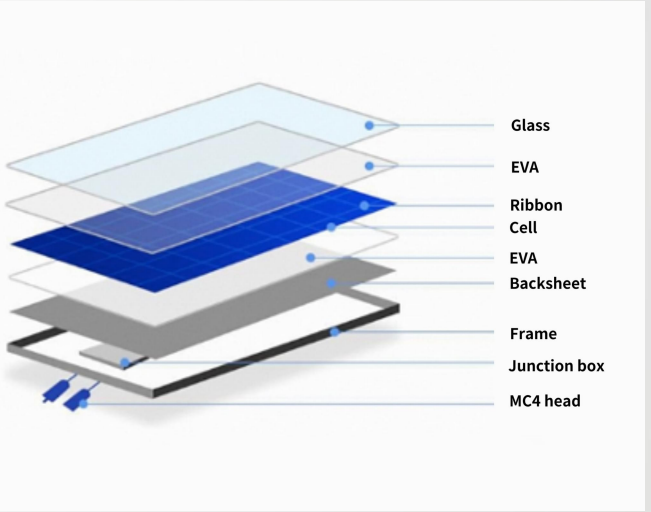
Actual Capacity：2,300-3,000 modules / shift

——10.5 h/shift, Uptime: ≥ 95%

- Plant layout design
- Equipment deployment/production line planning
- Semi-automatic production line/full-automatic production line on

■ Compatibility

Compatible Size	Standard length 1640-2520mm, width 950-1450mm other specs customized
Compatible Module	TOPCon, HJT, PERC, xBC, 0BB, SMBB, WMT
	Full-cell, half-cut cell, 1/3 cell, shingling
	Framed, framed(no C side), frameless
	Glass-backsheet, dual-glass/bifacial, ultra-light



ConfirmWare provide PV Module Manufacturing TURNKEY SERVICE

CONFIRMWARE

■ Key Equipment

High percentage of self-produced equipment,after-sales more convenient


Cell Stringer


Auto Layup Machine


Auto Bussing


Cell Cutting Machine


Auto Taping Machine


Glass Loader


EVA/TPT Laying and Cutting machine

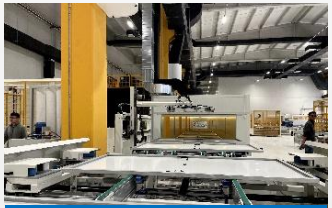

Automated Framing Machine


EL/VI Tester


Laminator


Auto Trimming Machine


Auto Junction Box Soldering Machine


Curing Manipulator


Sorting Manipulator

- ✓ HIGH PRODUCTIVITY
- ✓ HIGH AUTOMATION
- ✓ HIGH STABILITY
- ✓ BETTER ROI

Target: Reduce Costs and Improve Efficiency

- **Highly integrated**（Example：4-in-1 Stinger Equipment）
- Improvement of equipment technology
  （Example：Change of J-box Soldering from electromagnetic soldering to laser soldering）
- More Intelligent，Online Modular Control （Saving people）
- **AI Self-Diagnostic System**
- Lower Consumption

Customer Service in Global

CONFIRMWARE

Sales Footprint

20+ Countries and regions

3+ Global Service Center and Spare Parts Warehouse

500+ Global Project Operations

※ Overseas after-sales service centers and localized spare parts warehouses ensure stable operation of customer production.

Customer Service in India

CONFIRMWARE

Deeply cultivated in the India market for many years, familiar with the India cultural policies and regulations.

Efficient service team: Local installation and commissioning team to ensure project delivery, and after-sales service.

Mature and extensive local India program management and implementation experience

Set up local service centers in the India in 2023 to localize after-sales service and provide spare parts supply.

India Project

A	**500MW** PV module manufacturing line	Gurugram	2025
B	**400MW** PV module manufacturing line	Maharashtra	2025
C	**200MW** PV module manufacturing line	Greater Noida	2024
D	**1GW** High Speed Stringer with Inline NDC	Rajasthan	2024
E	**500MW** High Speed Stringer and layup bussing machine	Gujarat	2023
F	**200MW** PV module manufacturing line	Delihi	2023
G	**300MW** PV module manufacturing line	Gujarat	2022
H	**500MW** PV module manufacturing line	Uttar Pradesh	2021
.....			

Intelligent Manufacturing for a Green Future!

dron.kaura@bergengroupindia.com

Martin@confirmware.com

www.confirmware.com