Power Your Power

Robotic welding in Auto Industry

Case study: Honda cars

Brief layout

- Power Quality issues in Auto Industry
- Problems faced by the industry
- Graphical representation of power quality paramaters for Robotic welding
- Traditional solutions and its issues

Solutions and Case study

- IGBT based Hybrid PFC and its advantages
- Implementation in Honda cars
- Results achieved
- Conclusion

Introduction

Power Quality is a major concern in the Auto Industry. With increasing automation, the need for good power quality is increasing drastically.

Auto industry has the following major loads:

- ***Robotic welding***
- ***Stamping***
- ***Paint section***
- ***Assembly***

Issues faced by Auto industry

- Excessive failure of electronic cards in welding robots
- Excessive overheating of cables results in insulation breakdown
- Reduced utilization of transformers due to highle unbalanced load
- Poor voltage profile results in poor weld quality
- Increased losses due to improper utilisation of sources
- Production downtime due to random failures
- Unwanted tripping in robotic welding due to voltage dips

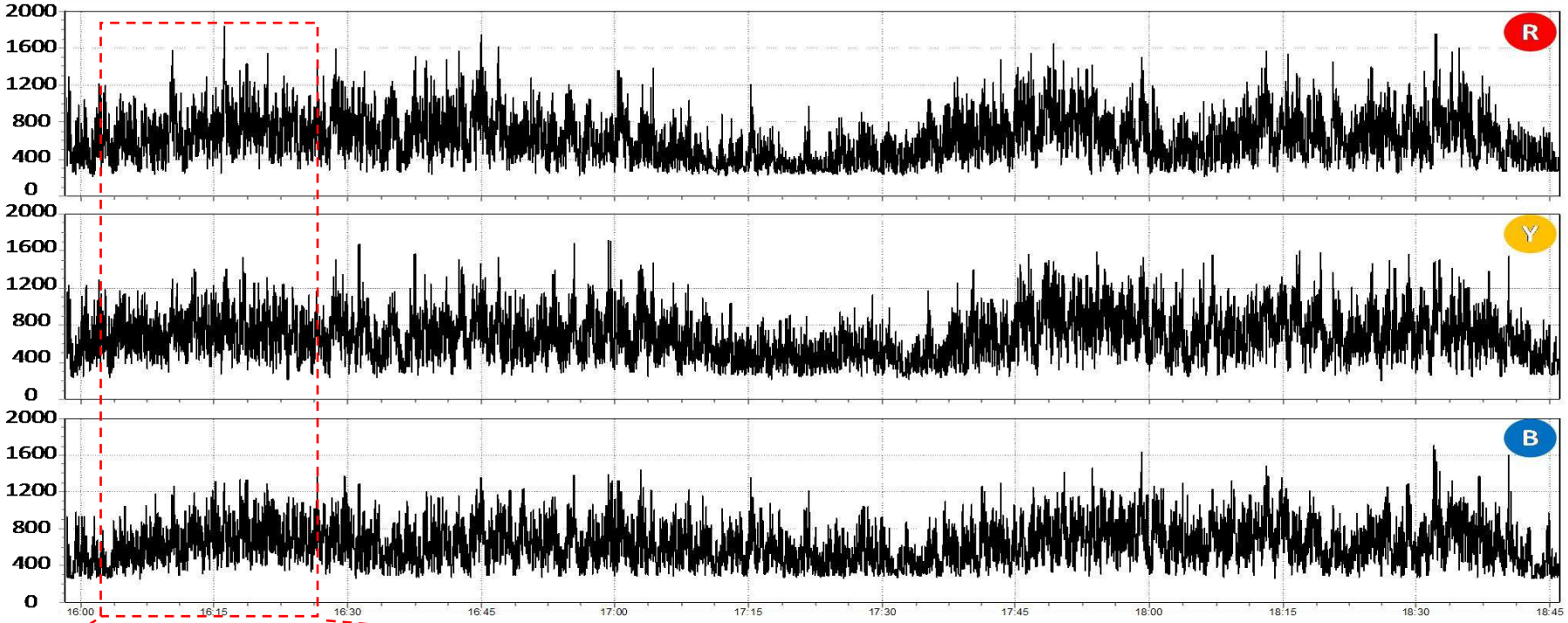
Welding robots represent all major PQ issues in a single load:

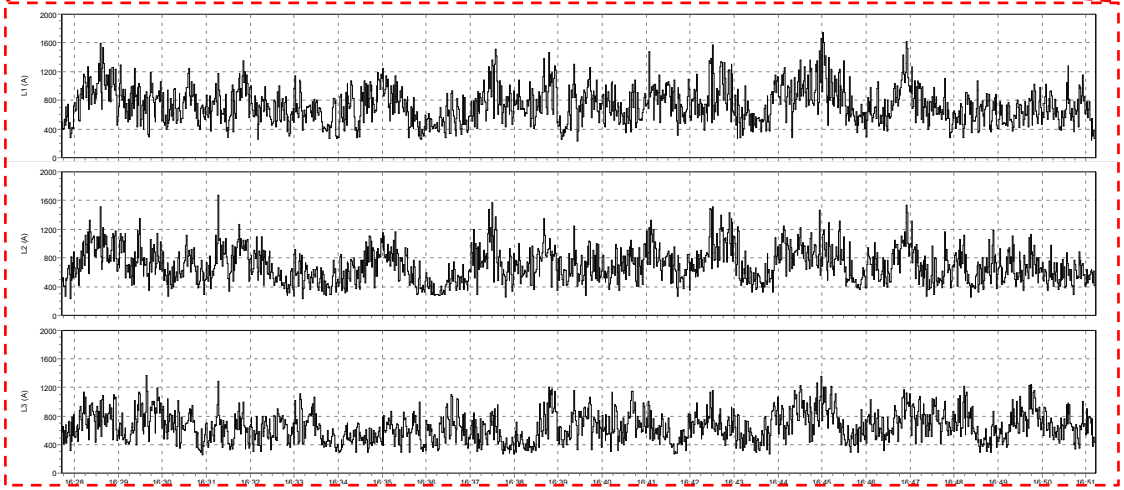
- *fast fluctuating*
- *jerky and demand sudden reactive power*
- *rich in current harmonics*
- *highly unbalanced*

PQ Issues...

Fast Fluctuating Profile

Load Current (A)





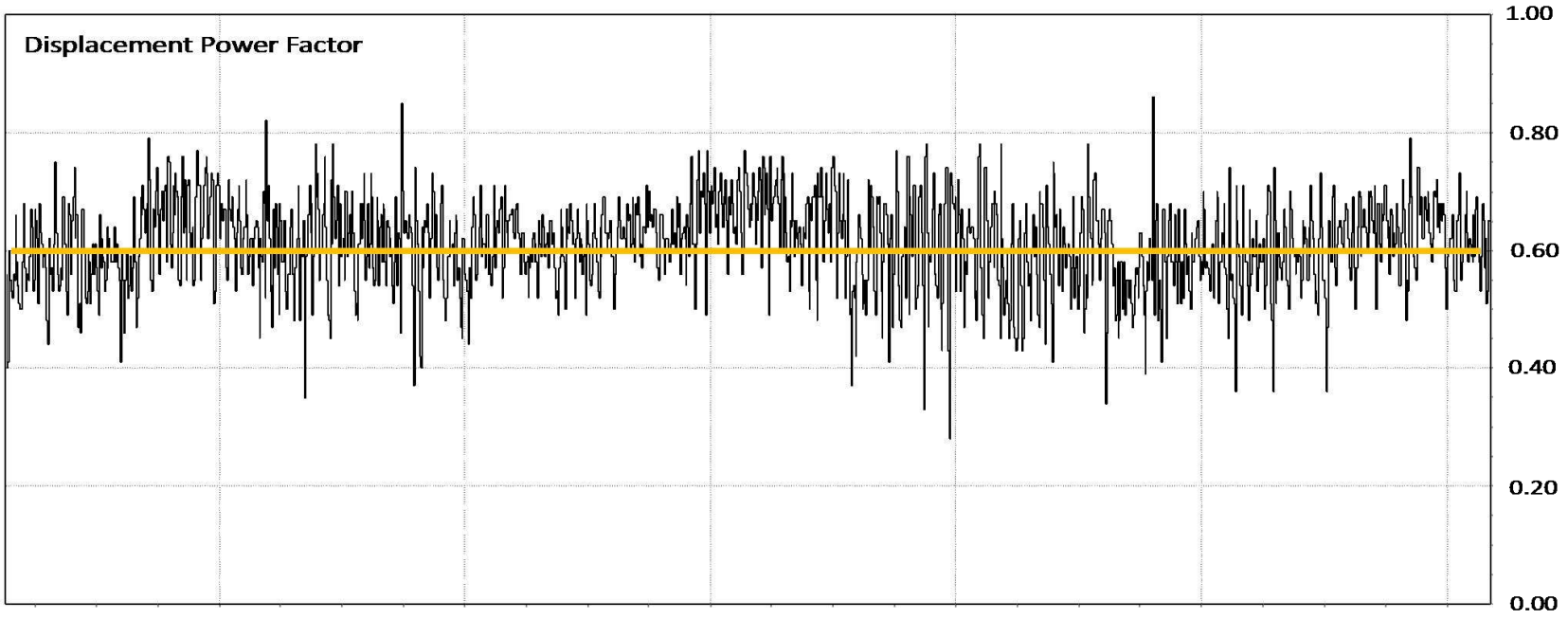
- Arms varying between 400 to 1000 Amps
- Fast fluctuating in nature
- Less than 100 ms jerks

PQ Issues...

Low Displacement Power Factor

- Net reactive demand continuously varies between 100 and 700 kVAR
- Fast fluctuating reactive power requirement
- Traditional solutions are ineffective due to fast fluctuations

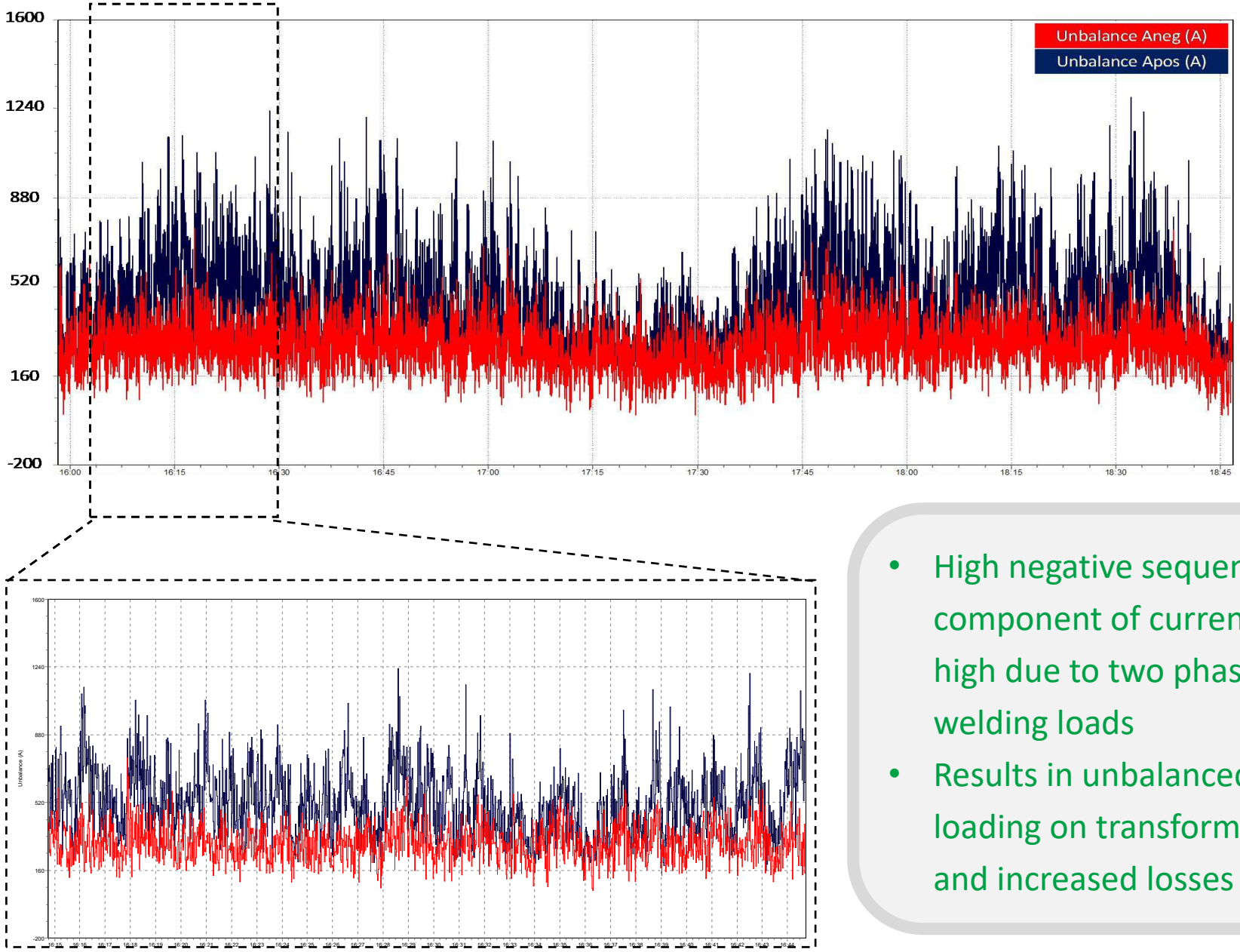
- DPF varying between 0.4 and 0.8
- Due to high reactive demand, extremely low displacement power factor
- Results in inflated peak demand



PQ Issues...

High Load Unbalance

Unbalance Apos and Aneg (A)

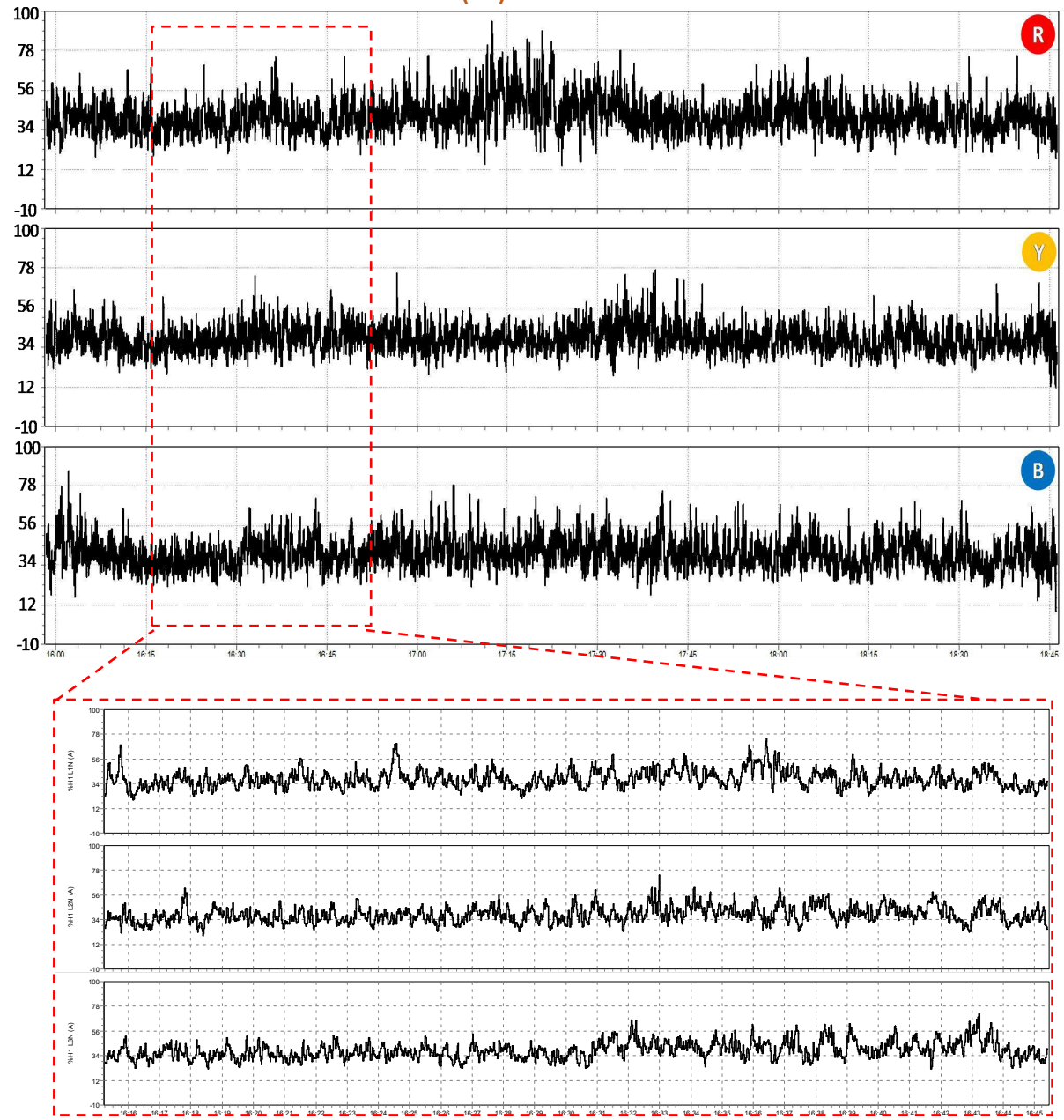


- High negative sequence component of current is high due to two phase welding loads
- Results in unbalanced loading on transformer and increased losses

PQ Issues...

High Harmonic Distortion

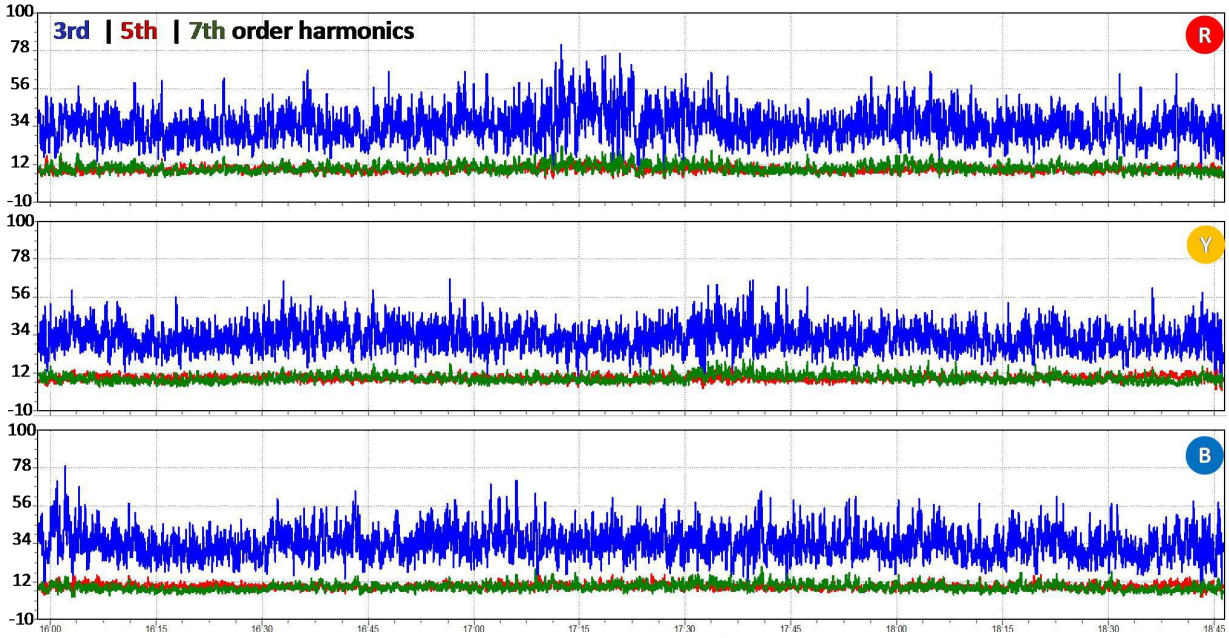
Current Harmonic Distortion (%)



- High level of current harmonic distortion: I THD is around 35-70%
- This reults in high voltage harmonic distortion at the transformer incomer which is a major cause of most electronic card failure in robotic welding

PQ Issues...

High Harmonic Distortion

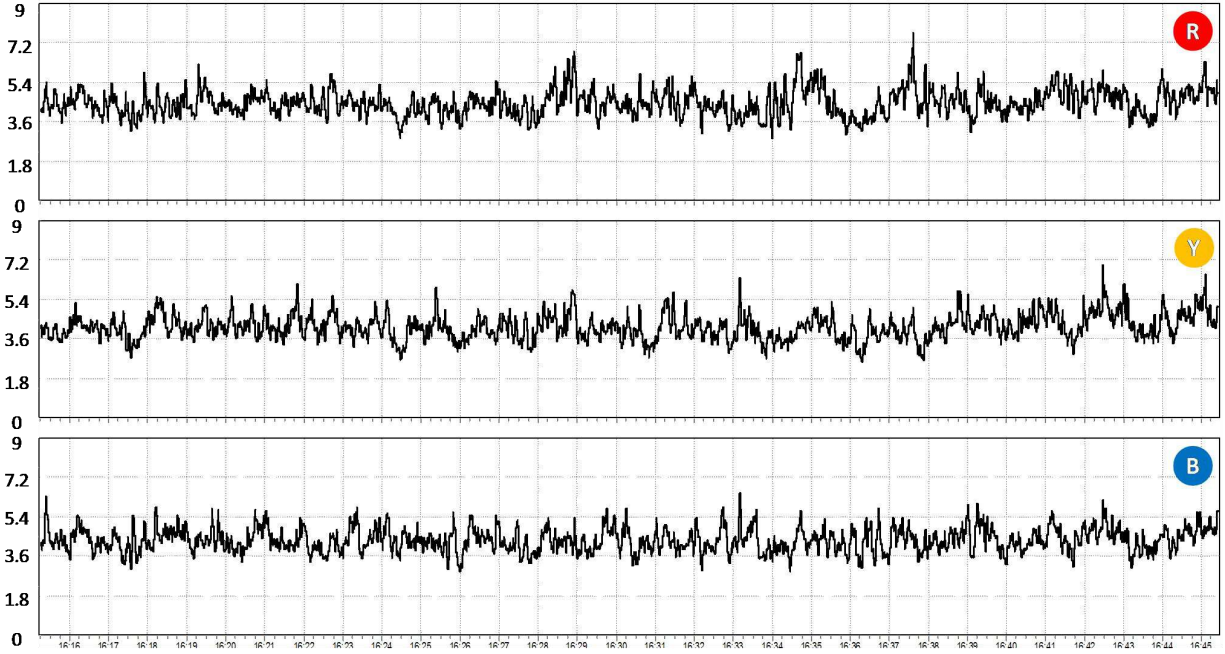


Individual Harmonic profile (%)

Predominantly high order individual harmonics are 3rd, 5th and 7th

Voltage Harmonic Distortion (%)

High current harmonics leads to high voltage harmonic distortion in the range of 5% to 8%



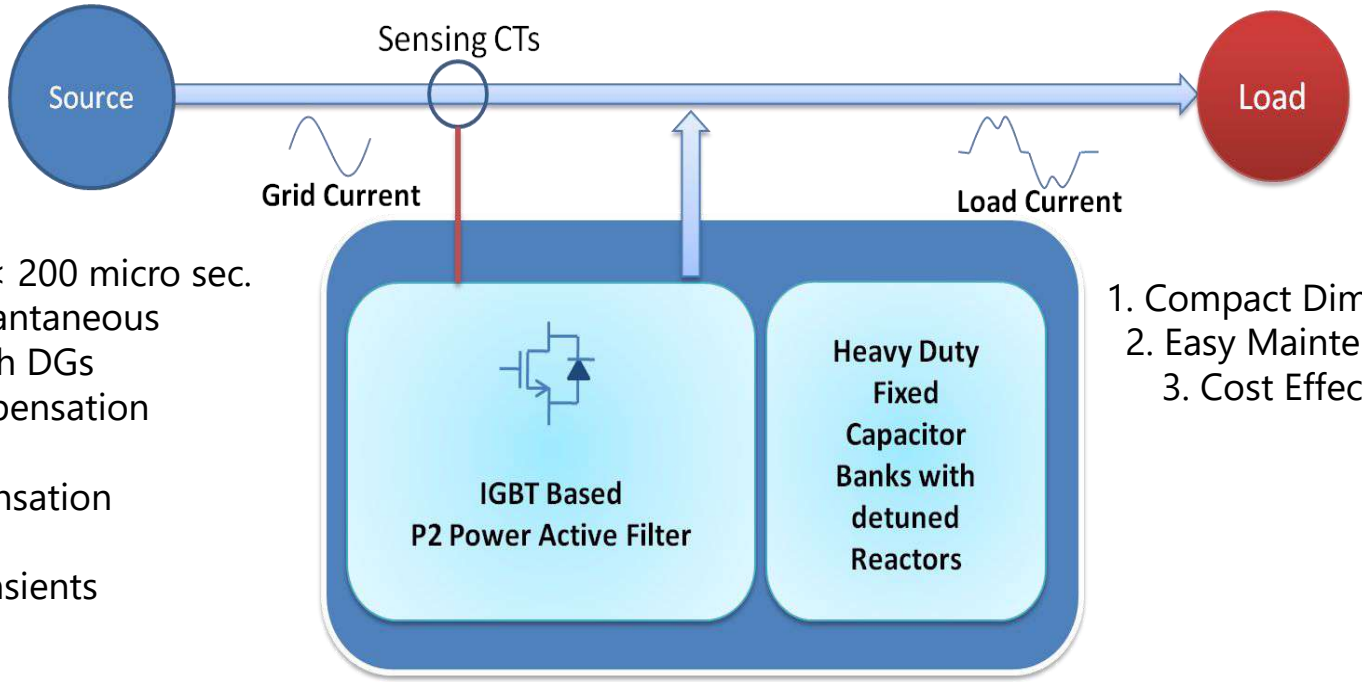
Traditional solutions: Issues

Traditional solutions like APFC panels and Thyristor based detuned power factor correction panels have their own set of issues. Some of them have been mentioned below:

- Slow response time
- Premature failure of capacitors
- Premature failure of thyristors / contactors
- Cannot perform load balancing
- Does not reduce harmonic content
- Does not reduce voltage distortion
- Requires high maintenance

Robotic welding requires a better and more advanced solution which can take care of all the above concerns with increased reliability

Hybrid Power Factor correction



1. Reaction time < 200 micro sec.
2. Stepless & Instantaneous
3. Compatible with DGs
4. Harmonic compensation
5. Load Balancing
6. Neutral compensation
7. Long life
8. No voltage transients

1. Compact Dimension
2. Easy Maintenance
3. Cost Effective

P2 Power Hybrid PFC combines the performance of Active Filter with the affordability of traditional Passive Solutions

Hybrid Power Factor correction

IGBT based P2 Power Hybrid PFC :

Combination of Active Power Filter & Passive system (APP heavy duty detuned capacitor banks)

1

Working :

Switching of detuned capacitors is controlled by the Active Filter's Advanced digital signal processor

2

Advantage :

Base load is catered by the passive banks whereas fine correction is achieved by utilizing the ultra fast and step-less response of the Active Power Filter

3

Special Feature :

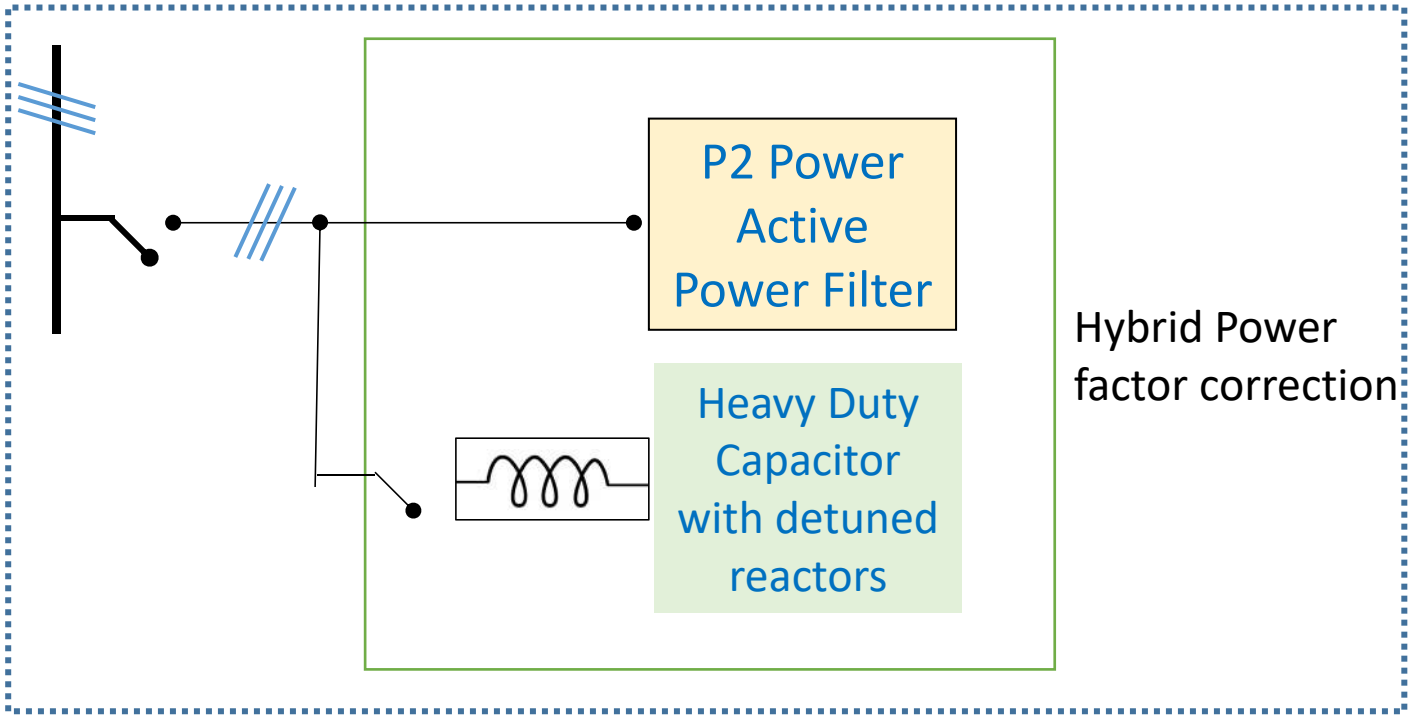
Together, the solution becomes extremely cost effective and provides the benefits of harmonic, unbalance and neutral compensation with ultra fast response

4

Hybrid PFC can take care of all power quality issues under a single unit at an extremely competitive price

HPFC: Brief overview

A complete solutions in itself to take care of Power Factor, Harmonics, Load Balancing & Neutral issues



Hybrid PFC has an Active Power Filter along with heavy duty APP type detuned capacitor banks

HyPFC can be programmed for

- *Reactive compensation*
- *Harmonic mitigation*
- *Load unbalance*

HPFC: Advantages against traditional

IGBT based P2 Power Hybrid Power Factor Correction system has following advantages over conventional system (detunedAPFC/ RTPFC)

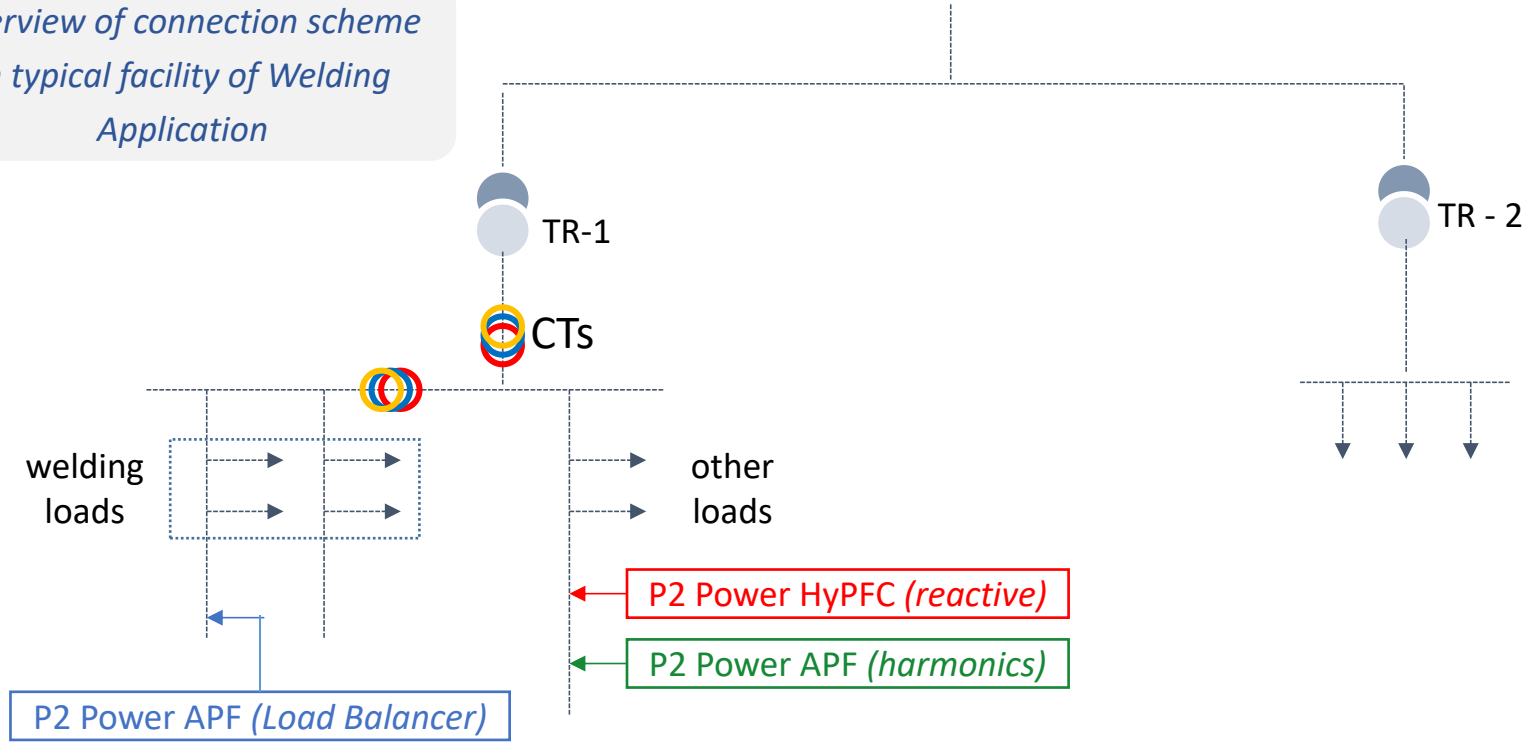
1. True PF compensation up to unity
2. Step less reactive compensation
3. Reaction time in micro seconds
4. Leading/Lagging both compensation
5. Harmonics compensation as per IEEE-519 standards
6. Maintenance free
7. Compact size
8. Optimum utilization of source
9. Runs on DG as well as Grid
10. Load balancing

Case study: Honda cars

P2 Power Solutions recommends :

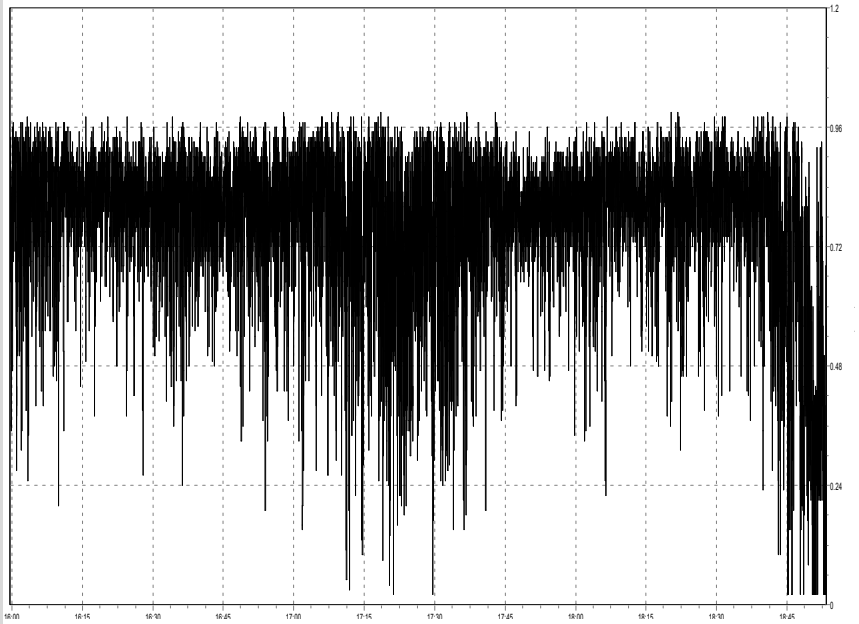
- P2 Power Hybrid Power Factor Correction System for reactive compensation and harmonic and load balancing on second priority
- P2 Power Active Power Filter for harmonic mitigation
- P2 Power Active Power Filter for balancing load

Overview of connection scheme in typical facility of Welding Application



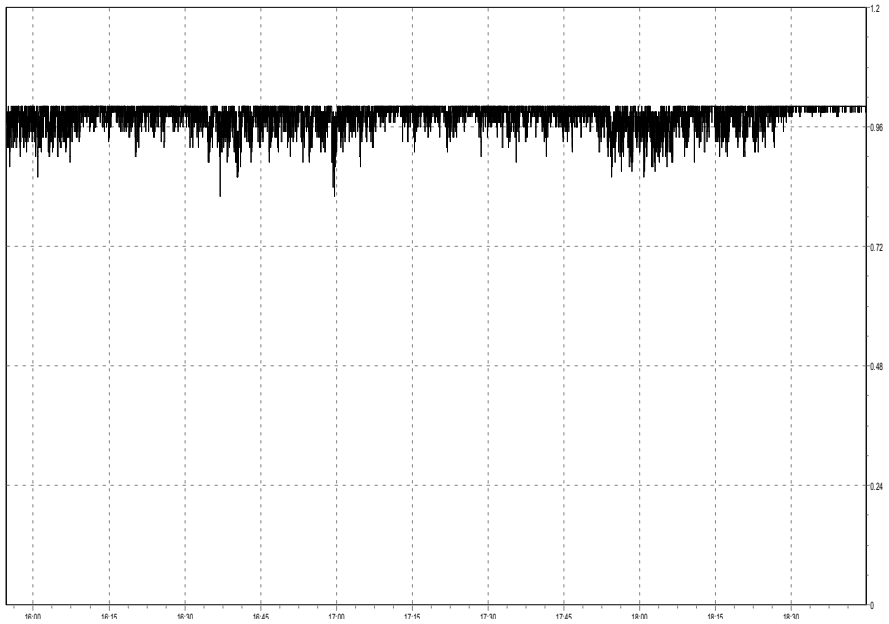
Performance Analysis

Displacement Power Factor (dPF) – Trend



Without HPFC

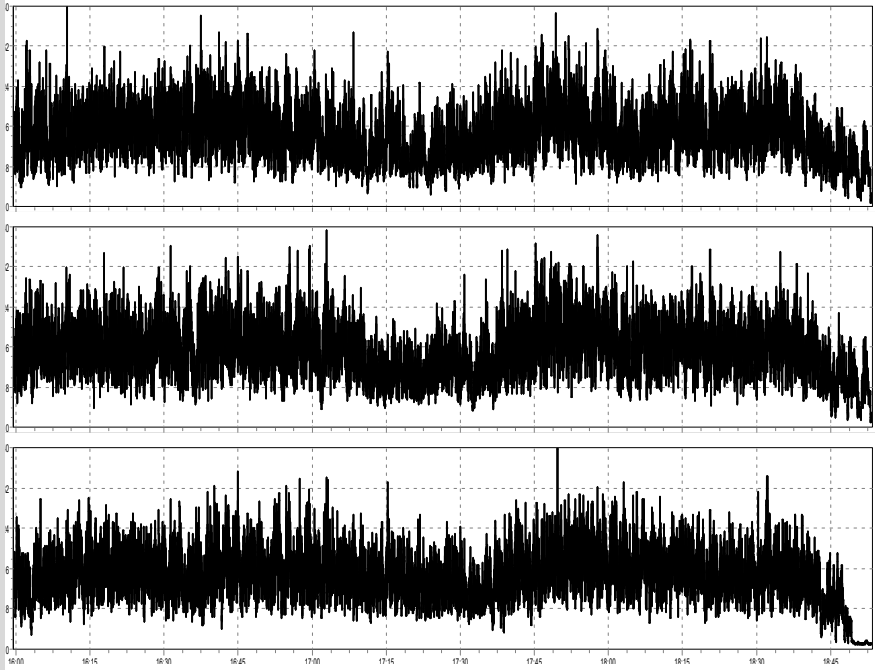
Improved from ~0.60 to > 0.99



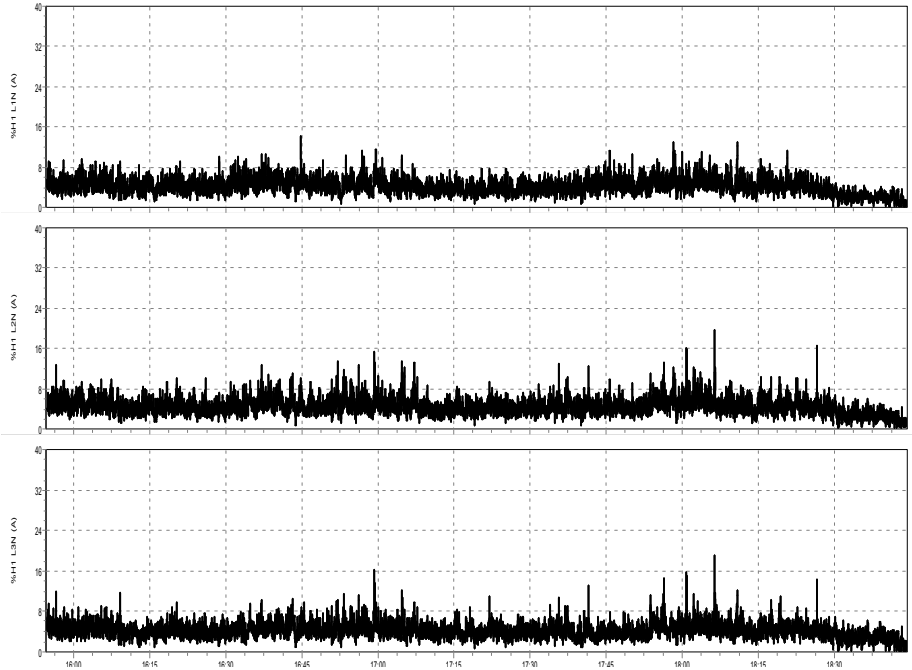
With HPFC

Performance Analysis

Current Demand Distortion (%iTDD) - Trend



Without APF

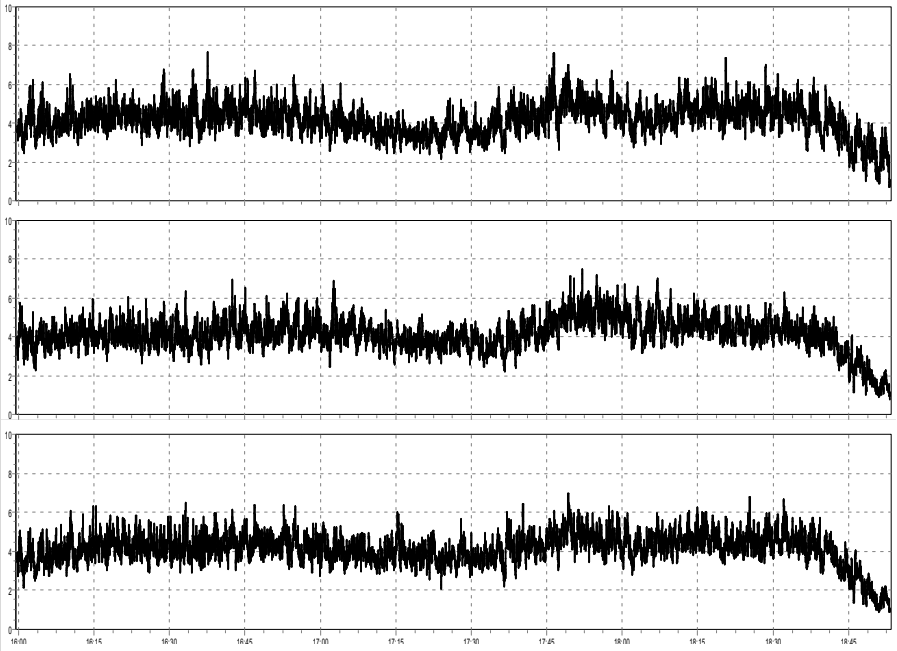


With APF

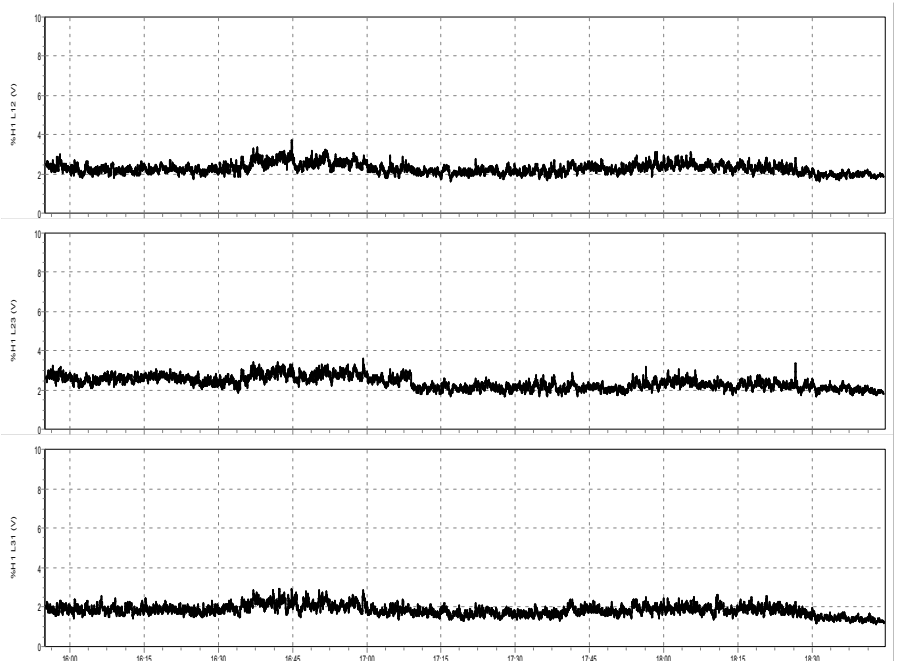
Improved from > 22% to < 7%

Performance Analysis

Voltage Harmonic Distortion (%vTHD) - Trend



Without APF

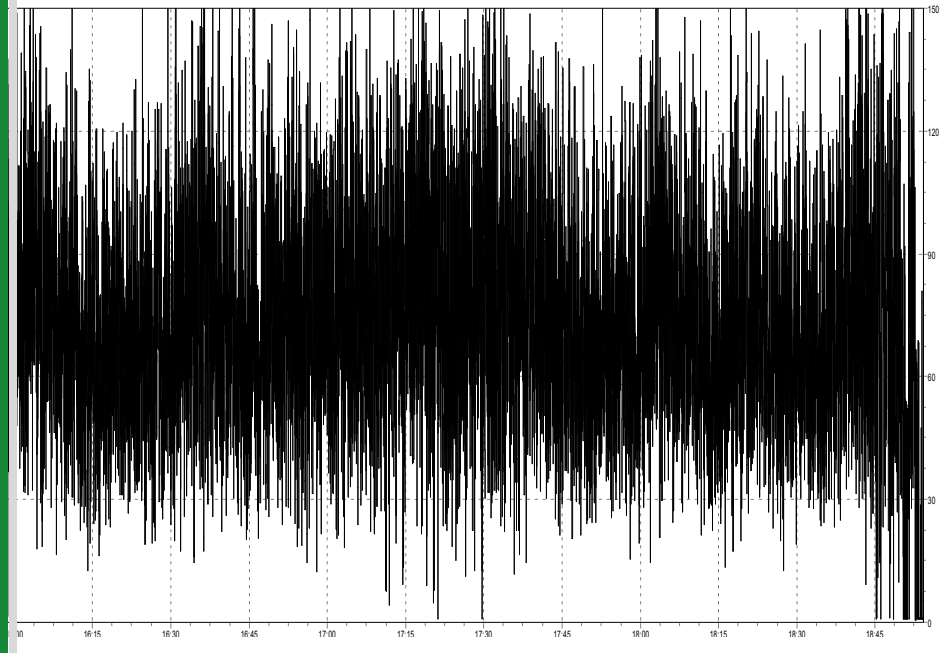


With APF

Improved from > 5% to < 2.5%

Performance Analysis

Current Unbalance (%Aunb) - Trend



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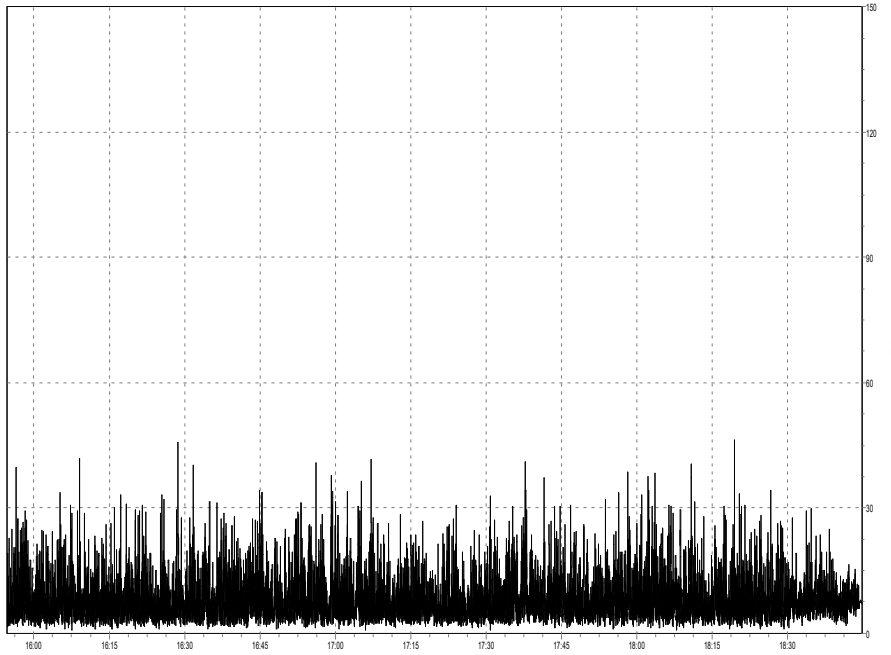

With APF

Reduced from > 60% to < 8%

Conclusion: Benefits for the customer

- Reduced risk of Failures
- Reduced Reactive Losses
- Reduced Maximum Demand charges
- No Overcompensation
- Improved Voltage profile
- Better weld quality
- Virtually maintenance free
- No more cable insulation breakdown
- Better transformer and DG utilisation

Expceptional savings, improved product quality and high uptime.

ROI less than 9 months for Honda cars!

Our installations across robotic welding

Premium Auto sector installations for Welding

Power Your Power

Thank You